ANGLIA RUSKIN UNIVERSITY

FACULTY OF BUSINESS AND LAW / CAMBRIDGE

BANK LIQUIDITY RISK AND ASSET AND LIABILITY MANAGEMENT AT JORDANIAN COMMERCIAL BANKS

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A Thesis in Partial Fulfilment of the

Requirements of Anglia Ruskin University for the Degree of Doctor of Philosophy

Submitted: August 2019

Acknowledgments

From the depths of my heart, I give thanks to my lovely supervisory team, Dr Ying Wang and Professor Nick Drydakis for their unlimited assistance in developing the main idea of this thesis. Indeed, they dedicated much of their time to helping me to complete this humble work to the best of my ability.

I dedicate this thesis to the memory of my beloved father, Awad Al-Naimi, and my mother. I would like to also share my success with my dear wife, Walaa Al-Mkhzomi, the supportive angel who gave up her time to help me, and my wonderful son, Mohammad, who I have missed spending time with while completing this goal.

It is also my honour to present my warmest thanks to my brothers and sisters who encouraged me during my PhD journey. I am also wholly indebted to Dr Rob Willis who welcomed me in my first journey to the faculty and explained to me the whole process and procedures for completing a PhD course at Anglia Ruskin University. It is my pleasure to thank the wonderful academic organisation ARU for all of its faculties, staff and academics for their cooperation in helping to make this work possible. I would also like to express my sincere thanks to the staff of the Lord Ashcroft International Business School for facilitating this journey.

ANGLIA RUSKIN UNIVERSITY (ARU)

FACULTY OF BUSINESS AND LAW

DOCTOR OF PHILOSOPHY

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August 2019

ABSTRACT

The relatively large size of the commercial banks in Jordan compared to other sectors in the economy as well as the turmoil in the MENA region motivated me to explore these organisations' asset liability management framework. This thesis utilized quantitative methods to study bank liquidity risk and asset and liability management (ALM) in Jordanian commercial banks over the period 2004 to 2015. The thesis evaluates the impact of the ALM framework on Jordanian commercial banks during 2017/2018 using questionnaires that explored the current framework of the ALM, the role of the asset liability committee (ALCO), and its effect on risk-management techniques in terms of liquidity, interest rate, credit, and market risks. It also investigates the tools used by commercial banks to estimate and set their risk exposures.

The results of the questionnaires indicate the existence of the ALM process in all of Jordan's commercial banks whereas ALCO only had limited authority in terms of identifying and setting risk exposures. The findings of this study show liquidity risk to be one of the most significant risks that Jordanian commercial banks have to mitigate against most of these banks rely on central bank guidelines to manage and set their liquidity and funding liquidity risk limits. The breadth of commercial banks' activities in Jordan as regards financing most of the economic sectors in the country through their role as financial intermediaries marks the importance of shielding them from liquidity risks.

The thesis analysed the impact of internal bank factors such as profitability, capital, credit, size and quality of management on liquidity risk for thirteen Jordanian commercial banks while controlling for the regulatory and macroeconomic environment using a panel data model. The econometric results show that profitability has a positive impact on liquidity risk whilst the existence of an efficient management has a negative impact on liquidity risk. Finally, the impact of capital and credit on liquidity risk had an ambiguous effect due to the interactions between the different factors.

Keywords: Risk Management, Commercial Bank, ALM, Liquidity Risk, ALCO, Jordan

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List of Abbreviations

ALCO	:	Asset Liability Management Committee
ALM	:	Asset Liability Management
ALPC	:	Asset Liability Policy Committee
ASE	:	Amman Stock Exchange
BRMC	:	Balance sheet Risk and Management Committee
BZ	:	Bank Size
CAR	:	Capital Adequacy Ratio
CBJ	:	Central Bank of Jordan
CD	:	Certificate of Deposit
CEE	:	Central and Eastern Europe countries
CEO	:	Chief Executive Officer
CFP	:	Contingency Funding Plan
CTIR	:	Cost To Income Ratio
DEA	:	Data Envelopment Analysis
DV01	:	Dollar Variation
ECB	:	European Central Bank
EQTA	:	Equity to Total Assets
FSA	:	Financial Services Authority
GCC	:	Gulf Cooperation Council
GDP	:	Gross Domestic Product
GMM	:	Generalized Method of Moments

HHI	:	Hirschman-Herfindahl Index
HQLA	:	High Quality Liquid Asset
IBR	:	Inter-Bank Interest Rate
ICAAP	:	Internal Capital Adequacy Assessment Process
IFRS	:	International Financial Reporting Standards
ILG	:	Individual Liquidity Guidance
IMF	:	International Monetary Fund
JD	:	Jordanian Dinar
LCR	:	Liquidity Coverage Ratio
LMI	:	Liquidity Mismatch Index
LOLTA	:	Non-Performing Loans to Total Assets
LQATA	:	Liquid Assets to Total Assets
LTD	:	Loan to Deposits ratio
M2	:	Money supply
MARS	:	The Market Share
MENA	:	Middle East and North Africa
NIM	:	Net Interest Margin
NPLs	:	Non-Performing Loans
NSFR	:	Net Stable Funding Ratio
OECD	:	The Organization for Economic Cooperation and Development
OLS	:	Ordinary Least Squares
REPO	:	Repurchase Order Agreement

RGDP	:	Real Gross Domestic Product
ROA	:	Return On Assets
ROAA	:	Return On Average Assets
ROAE	:	Return on Average Equity
ROE	:	Return On Equity
RRR	:	Required Reserve Ratio
SBI	:	State Bank of India
SFA	:	Stochastic Frontier Analysis
SLS	:	Stage Least Squares
SMEs	:	Small and Medium-sized Enterprises
SPSS	:	Statistical Package for the Social Sciences
SUR	:	Seemingly Unrelated Regression
TAS	:	Total Asset
TCR	:	Total Capital Ratio
TIER 1	:	Regulatory Capital
TLT	:	Total Liability
UAE	:	United Arab Emirates
UK	:	United Kingdom
US	:	United states of America
USD	:	United States Dollar
VaR	:	Value At Risk

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Chapter One: Introduction

1.1 Background of the study

In the last decade, many countries in the MENA[1] region have started to implement various structural reform programmes. The financial and banking sectors have not been isolated from these reforms, which were directed towards preserving the stability of the financial system in the region. The speed and magnitude of these reforms differed between the MENA countries, which resulted in the banking industry in these countries developing different characteristics. The procedures and policies that charted the attitude of these banks have been affected by the regulatory and political developments in their region (Abed & Davoodi, 2003).

Jordan, as a part of this region, has adopted a series of reforms with liberalization components concerning both the financial and real sectors in the economy since the early 1990s in collaboration with the IMF and the World Bank. These measures accelerated the Kingdom of Jordan's economic and financial growth by attracting foreign investment and creating more jobs. However, the political instability in the MENA region since the awakening of the Arab Spring in 2010, and weakening global demand due to the Global Financial Crisis, exacerbated the challenges facing the economy. These shocks have weakened Jordan's external and fiscal positions (CBJ, 2013). In response to these challenges, Jordan adopted a national reform program backed by the IMF to stabilize the economy and address Jordan's economic vulnerabilities by correcting for fiscal and external imbalances while safeguarding its currency peg (IMF, 2012).

[1] MENA countries according to the IMF classification include: Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, UAE, and Yemen (IMF, 2018).

The development of the monetary policy and regulatory frameworks came hand in hand with the adopted reforms in order to preserve Jordan's monetary and financial stability, which is heavily influenced by exogenous factors. These policies have shifted from directly influencing market conditions through setting market interest rates and controlling monetary aggregates, to depending on indirect monetary policy tools to influence the market by manipulating short-term interest rates (Maziad, 2009). The evolution of monetary policy frameworks could be classified into three main stages: pre-currency crisis monetary policy where the financial sector was characterised by low complexity; post-currency crisis monetary policy where the monetary authorities shifted towards depending on indirect tools to influence the market; and the Arab spring framework where the authorities developed a toolkit to preserve financial stability in the face of the looming uncertainty in the region (IMF, 2012; CBJ, 2015).

The massive evolution in macroeconomic fundamentals as well as the innovation in the banking industry have radically increased the importance of the sector as it is currently considered one of the key pillars supporting the Jordanian economy. Jordan's banking sector currently includes 25 operating banks. These comprise 16 Jordanian banks, three of which are Islamic banks, and nine branches of foreign banks, including one foreign Islamic bank. These banks operate through a network of 785 branches and 82 representative offices. Thus, one could argue that the market is broadly saturated. However, the banking industry relies on traditional services; therefore, a wide range for expansion opportunities is still available (Almumani, 2013). Furthermore, the banks' outstanding balances of assets have accelerated dramatically by more than three-fold since the early 2000s to reach around USD 66.4 billion at the end of 2015. In addition, total assets to GDP rose to on average 202.8 percent over 2000 to 2015.

Although it declined on a steady basis from 222.4 percent in 2001 to 176.9[2] percent in 2015, it still demonstrate the importance of ensuring the resilience and viability of the Jordanian banking system and illustrates the need to strengthen internal and regulatory control systems through ensuring that banks effectively manage both sides of their balance sheets .

The image of the banking industry in Jordan has evolved over the past two decades from its traditional role as financial institutions in the business of taking deposits and advancing loans to now engaging in a wide range of products and services across the international markets (Choudhry, 2011). These developments have happened in parallel with the increasing complexity of the financial markets and the degree of financial innovation. Furthermore, the recent turbulence, high volatility, and uncertainty in the global financial markets have increased the need for banks to adopt a comprehensive framework to manage these developments. The nature of the operations within financial institutions and the risks that faces them is reflected in their balance sheets. More specifically, the asset side of a balance sheet expresses the risk of the surrounding environment, while most of the risks stemming from business operations are revealed on the liability side; aligning these risks is the main purpose of asset and liability management (ALM). This practice is considered to be a vital issue for banks' strategic planning, assessment and management of their endogenous financial operations and external risks as it provides quantifiable measures of risk and management strategies (Choudhry , 2011; Tektas, 2005). In addition, ALM should also be seen in order to attain a defined net interest income to be regarded as a vibrant planning, coordination and control of assets and liabilities as well as their mixes, volumes, maturities, returns, and cost (Charumathi, 2008). Accordingly,

[2] Source: Central bank of Jordan and author's calculation.

ALM includes credit, liquidity and interest rate management using a variety of tools that are calibrated to mitigate risks and optimize the working environment. Therefore, asset liability management is a necessity to express the needs to manage both assets and liabilities simultaneously in order to mitigate various and fundamental risks, and manage both sides of the balance sheet to control interest rate and liquidity risks (Bessis, 2011). In addition, setting the overall strategy for commercial banks to effectively manage asset-liability components requires focusing on various pillars. The first pillar is concerned with managing the banks' liquidity position in terms of their liquid assets and maturity profile while taking into account the market conditions. The second pillar focuses on risks stemming from day-to-day operations such as default risk (Choudhry, 2011).

The existence of financial institutions and their roles have been discussed at length in the literature. There are two primary reasons for the existence of these institutions, and banks in particular. The first is the provision of liquidity. Banks accept funds from depositors and use these funds to provide various services to borrowers through maturity transformation (BIS, 2008). Liquidity lies in two main areas: financial securities in the markets and solvency. Financial instruments are often associated with their level of liquidity in terms of whether they are marketable and if there are financial barriers to transactions. On the other hand, solvency is closely related to the obligations of financial institutions to meet their payments to their counterparts (Fiedler, 2000), which can be dealt with through setting up appropriate liquidity management policies and balancing their portfolios The importance of the banking system in Jordan and the breadth of their financing to most of the economic sectors in the country due to their role as financial intermediaries marks the importance of having proper liquidity management practices in place. Liquidity problems at banks often arise from poor liquidity management as commercial banks' commitments and transactions have implications for their

liquidity. Therefore, liquidity risk has become a key element in banks ' risk management frameworks to assist banks retain adequate liquidity to resist the effect of stresses they face. To ensure proper functioning of the banking system, the banks should conduct regular periodic assessment of the framework with their supervisory bodies.

The global financial crisis and its impact on the banking system in advanced economies as well as in some emerging markets impacted financial stability substantially. Many large banks faced severe liquidity shortages and often the central banks intervened to prevent them from failing and provided them with funding (Vodova, 2011; Farhi & Tirole, 2012; Agnello & Sousa, 2012). In addition, protecting depositors as well as investors became an imperative issue for the authorities.

Therefore, banks started to pay more attention to sources of financial weakness, which are related in part to the liquidity risks that are represented by banks' inability to meet their obligations due to sudden withdrawals from depositors or the improper management of resources. These turbulences have increased the need in the financial market to preserve liquidity positions through focusing on liquidity management and the risks stemming from liquidity positions. Therefore, the nature and structure of the Jordanian economy left most of its sectors more susceptible to exogenous shocks and spill-overs from the global economy as well as its neighbouring countries (CBJ, 2015). The relatively large size of the commercial banks in Jordan compared to other sectors of the national economy highlight the need for the Jordanian authorities to shield the banking sector from the negative effects of these crises. This is achieved through improving the efficiency of the industry by enhancing banking regulations and developing sound operational risk methodologies in the banking system to ensure the stability of the banking system. Many of these measures include liquidity and portfolio management (CBJ, 2000). These regulations are aimed at

preserving the viability of the banking system through achieving the right balance between risk-taking and profitability. Commercial banks and regulatory authorities are paying more attention to bank-specific indicators as signals for the internal control systems in these banks and the regulatory authorities for the soundness of the overall industry and at the micro level. Thus, adopting an effective framework that mitigates against risk and allocate resources more effectively is essential for the banking sector (Choudhry, 2011).

The thesis discusses the necessity of ALM and the core functions of ALCO at Jordanian commercial banks. This part of the study relied on a survey of Jordanian banks to describe the ALM process and roles of the ALCO within their operations. The importance of this part stems from the challenges that the banking industry in Jordan faces:

- Downside risk due to geopolitical instability in the region, which impacts the branches of Jordanian banks abroad.
- The difficult macroeconomic environment that impacts banks' ability to mitigate against risk while maximizing their profits. Hoarding liquidity may be one of the behaviours that may cause liquidity shortages in the market and limit the distribution of liquidity amongst banks through interbank lending.
- The underdeveloped financial market, which limits banks' ability to diversify their assets and hinders the alignment between short-term and long-term strategic plans. Therefore, having an efficient ALM framework is crucial to ensure the soundness of the banking sector.

The second part of this thesis aims to identify the influence of internal factors on liquidity, such as profitability, capital, size and non-performing loans on liquidity risk that are proxied using the loan to deposit ratio (LTD) as well as the liquid assets to total assets ratio (LQATA). Furthermore, this research will fill a gap in the knowledge and understanding

concerning the impact of bank internal factors on liquidity risk exposures at commercial banks in Jordan as – to the best of my knowledge – few studies have addressed the impact of internal factors on liquidity risk among Jordanian commercial banks. The importance of this research comes from the fact that Jordanian banks constitute around 95% of the financial sector and have a high ratio of assets to GDP that exceeds 150% (CBJ, 2016). Furthermore, current developments in the banking sector in Jordan are presenting additional challenges:

- High downside risks stemming from the economy and the geopolitical issues in neighbouring countries are yet to be reflected in internal liquidity management strategies and implemented effectively.
- The conservative nature of the Jordanian commercial banks as well as the market structure reveals that banks with high levels of liquidity tend to be more conservative in their approach towards the market, which could result in an inefficient use of resources and result in high costs from hoarding liquidity. On the contrary, banks with liquidity shortages tend to have a more aggressive approach to maximizing their profits and try to acquire expensive liquidity funding, hampering their performance.
- Compared to advanced economies, Jordanian banks operate within an underdeveloped financial and money market.
- Preserving a healthy banking sector is depends on banks' ability to implement proper liquidity management.

1.2 Research Motivation

The availability of liquidity at banks is an integral part of safeguarding the banking system through ensuring banks' ability to fulfil their obligations and have the creditworthiness of depositors. In Jordan, commercial banks play a vital role through providing a variety range of

services to many sectors in the economy. Thus, having enough liquidity and easy access to its sources is an essential requirement to ensure the strength of the banking system, economic stability and growth. Therefore, insulating this sector from exogenous shocks is one of the core functions of Jordan's monetary authorities, mainly through regulatory measures.

The nature and structure of the Jordanian economy has left most sectors more susceptible to exogenous shocks and spill-overs from the global economy as well as its neighbouring countries. The authorities in Jordan have tried to shield the banking sector from the negative effects of these crises and keep the system stable. They have done this by improving the efficiency of the industry by enhancing banks' regulations and by developing sound operational risk methodologies in the banking system. Many of these measures included liquidity and portfolio management (CBJ, 2000). Furthermore, monetary authorities' regulations have mitigated against liquidity risks in the banking system through managing liquidity buffers as they expect to receive funding from the central bank in the event of a shortage (Aspachs, et al., 2005). The size of the commercial banks in Jordan compared to other sectors in the economy, the turmoil in the MENA region, and the recent turbulence in the global financial markets and its repercussions on the external portfolios of Jordanian banks all pose a serious threat to both the banking system and portfolios valuations. This reinforces the need for a comprehensive ALM framework for the banking sector to ensure that banks manage their liquidity properly.

1.3 Aims and Objectives of This Research

The thesis covers two main themes. The first section describes the current ALM framework and role of ALCO in Jordanian commercial banks through conducting a survey. More specifically, it aims to explore the commercial banks ' behaviour in Jordan in terms of managing their balance sheets and the tools that they use to mitigate risks. The second part

is concerned with those factors that impact liquidity risk at banks by focusing on internal factors such as profitability, capital, credit, size, and quality of management, while controlling for the impact of the regulatory and macroeconomic environment on commercial banks. It is hoped that the second part will help Jordanian commercial banks to identify the impact of internal factors on liquidity risk and could be applicable to commercial banks in other countries with similar characteristics to the Jordanian banking system. The study will be limited to Jordanian commercial banks, which is a main part of the banking sector in Jordan, notwithstanding the role of Islamic banks in the financial sector as well as the economy. Sharia-compliant banks have different products and practices that are beyond the scope of this thesis.

1.4 Research Questions

This research has been designed to test the following questions:

Q1: Do Jordanian commercial banks have an effective ALM framework?
Q2: Do Jordanian commercial banks with high profitability ratios face higher liquidity risk?
Q3: Do Jordanian commercial banks with high non-performing loans face higher liquidity risk?
Q4: Do large Jordanian commercial banks face higher liquidity risks?
Q5: Do Jordanian commercial banks with higher capital face lower liquidity risks?
Q6: Do Jordanian commercial banks with higher efficiency face lower liquidity risks?

To achieve the main aims of this research and the research questions, the study formulated one main hypothesis for asset and liability management and five main hypotheses for liquidity risks at Jordanian commercial banks, as follows, for ALM:

Hypothesis (1): Jordanian commercial banks have an effective ALM framework.

This hypothesis will be tested through the following sub-hypothesis:

Hypothesis (1.1): ALCO is effectively involved in implementing ALM strategies and policies in Jordanian commercial banks.

Hypothesis (1.2): Liquidity risk management in Jordanian commercial banks is consistent with the banks' overall strategy and takes operational liquidity needs into consideration.

Hypothesis (1.3): There are contingency funding plans in place in Jordanian commercial banks to deal with liquidity concerns.

Hypothesis (1.4): Stress Testing scenarios in Jordanian commercial banks are efficient in liquidity management aspects.

The study formulated five main hypotheses for the liquidity risks at Jordanian commercial banks as follows:

I. Liquidity Risk and Profitability
- Commercial banks with high profitability ratios face higher liquidity risk.

II. Liquidity Risk and Credit Risk
- Commercial banks with high non-performing loans face higher liquidity risk.

III. Liquidity Risk and Bank Size
- Large Commercial banks face higher liquidity risks.

IV. Liquidity Risk and Capital
- Commercial banks with higher capital face lower liquidity risks.

V. Liquidity Risk and Banking Efficiency
- Commercial banks with higher efficiency face lower liquidity risks.

1.5 Research Structure

This research is presented across five chapters. This chapter has introduction for the thesis and the second chapter provide an overview of commercial banks that operate in Jordan. In chapter three, the study presents the ALM process within Jordanian commercial banks and the role of the ALCO, with a special focus on liquidity management. The fourth chapter investigates the impact of banks' internal factors on their liquidity risk. Finally, the fifth chapter presents the study's conclusions, recommendations and final remarks.

Chapter Two: Overview of the Jordanian Banking system

2.1 Introduction

In an extremely political volatile region, Jordan has a tiny, open economy. The structure of the economy and the macroeconomic policy framework has been largely shaped by exogenous shocks and spill-overs from regional economic partners. Thus, the economy is vulnerable to exogenous shocks, especially from its neighbouring trading partners' countries. Another feature of the Jordanian economy is that it's a service sector based economy, the service sector constituted around 66.6 percent from the country's GDP in 2017 (CBJ, 2017). The "Finance, Insurance, Real estate and business services sector" constitutes around 24.4 percent of the GDP in 2017 and 34.6 percent of the service sector on average for the period (2005-2017) (CBJ, 2017).

The awareness about the challenges paved the way for establishing series of reforms with liberalization components concerning both financial and real sectors in the economy since the early 1990s in collaboration with the IMF and the World Bank. These measures accelerated Jordanian economy and financial growth by attracting foreign investment and creating more jobs. However, the political and military instability in the MENA region since the awakening of the Arab Spring in 2010, and the weakening global demand due to the global financial crisis exacerbated the challenges that faces the economy. These shocks weakened Jordan's external and fiscal positions (CBJ, 2013). As a reaction to these challenges, Jordan has adopted a national reform program backed by the IMF to steady the economy and address Jordan's economic vulnerabilities (IMF, 2012).

This chapter will discuss the evolution of the macroeconomic fundamentals of the Jordanian economy as well as the banking system. The first part will discuss the evolution of

the monetary policy frameworks, in order to preserve monetary stability that is heavily influenced by exogenous factors. The main reason for tackling the consecutive update of monetary policy changes is to illustrate the building blocks for the current monetary and regulatory policies adopted by the authorities in Jordan to preserve financial stability. The researcher has classified the evolution of monetary policy framework into three major categories, the pre-currency crisis, post currency crisis, and the Arab spring monetary framework. The reason behind this classification is that the major changes in the monetary frameworks could be attributed to exogenous shocks that compelled authorities in Jordan to adapt in order to stabilize the macroeconomic conditions.

Further, this chapter will summarize the evolution of the Jordanian banking sector with regards to balance sheet management (ALM) during the period of (2004-2015). This period witnessed a massive evolution in the banking industry compared to prior periods which were dominated by the heavy control over banking activities and sectoral reforms that paved the way for the current evolution in the banking industry.

2.2 Monetary Policy Framework

The degree of autonomy for the CBJ, which started its operations in 1964, increased considerably especially after the currency crisis in late 1980s. Thus, the study can divide the framework for monetary policy operations into three main parts; Pre-currency crisis monetary policy, Post-currency crisis monetary policy, and the Arab spring framework. The evolution in the monetary policy framework in all the stages depended on the evolution of the internal and external environment.

At the early stage, the Jordanian authorities tried to establish the basic institutions to regulate the financial sector such as the Central Bank (1964) and (ASE) in (1978).

Consequently, the financial sector was characterized by low complexity with few choices of financial securities available for trading. The investors were mainly self-reliant in financing their own projects or depended on loans from traditional banks which was heavily controlled by the CBJ. At later stages the lending conditions were market-oriented after the currency crisis in 1989. Monetary policy in Jordan was directed towards influencing banks' ability through influencing the amount of their excess reserves and their ability to access the discount window at the CBJ (Maziad, 2009).

But in late 1993, the CBJ started to depend on the indirect monetary policy tools to influence the market by manipulating the short term interest rates through auctioning CDs (three and six months), the REPOs to manage the liquidity in the market. Before introducing the overnight window deposit facility to manage liquidity in a daily basis in the early 2000. The second stage, witnessed a shift in the overall policy framework as well as change in the operational target from the CDs to inter-bank rate.

The third stage, which could be characterized by the ability of the CBJ to minimize the uncertainty in the economy witnessed an introduction of the weekly REPO, building a portfolio of government bonds to influence the liquidity quantity and structure in the market, the forward foreign exchange operation at the discretion of commercial banks, and the introduction of the CBJ main rate, as a reference for the banking system to manage their liquidity efficiently. These tools helped the CBJ to manage liquidity more effectively and influence the market at times of high uncertainty.

2.2.1 The Pre-Currency Crisis Framework

The CBJ started its operations in 1964, before that time many commercial banks were entrusted to carry these operations as the bank of the government, but after the establishment

of the CBJ and the announcement of its law in 1960, the CBJ started its main functions as a bank for the government and the banking sector in Jordan, a regulator for the bank notes and coins, cost and quantity of credit to meet the requirements of monetary stability and economic growth, and to manage the Jordan`s gold and the foreign exchange reserves. The CBJ law was amended in 1966 due to some deficiencies and to allow the bank to be more resilient and increase its ability in addressing its main functions (CBJ, 1970).

The main goal for this is to make the countries' law, especially the public debt law, to be more compatible with the CBJ law and to have more powers in the supervision of banks operating in Jordan. In 1971, a new law for the CBJ was announced; the aim of this law is to be in line with the changes in the world monetary system. Further, the cabinet has taken the decision to fix the exchange rate with the US dollar. The monetary policy at that time has limited instruments and relied on direct intervention in the market to influence liquidity and credit conditions in the market as the monetary policy was set to accommodate the authority's policies in stimulating the economy and support the adopted development plans.

But since the early 1980s, the oil prices began to fall from around 30 USD per barrel to 15 USD per barrel in 1986, and continued its downward trajectory till the end of the decade. The structural decrease in oil prices resulted in sharp reductions of capital flows, remittances, and grants to Jordan. These declines forced the authorities to rely heavily on external and internal borrowing to finance its budget deficit (Schlumberger, 2002).

2.2.2 The Economic Crisis Of 1989

The expansionary fiscal policy and debt reliance have led to the currency crisis in late 1989 as the public debt reached high unsustainable levels. In 1988, the government's total debt reached around 203% of GDP, and interest payments increased due the increasing in foreign

debt to almost 11% of GDP in 1990-91. The conditions and the low level of foreign reserves forced the authorities to devaluate the JD strongly. (IMF, IEO, 2005). The pressures on the currency caused a substantial loss of reserves as foreign reserves fell to JD 110 million in 1988, from nearly JD 425 million in 1987 (Maziad, 2009). In 1988, the CBJ suspended currency sales and decided to float the JD which resulted in a sharp devaluation in the currency against the USD by 20.9 percent till the end of 1988. Further, the authorities decided to limit the transfers of foreign currency to abroad. (CBJ, 1992).

The monetary policy in Jordan during that period was mainly passive, with little instruments available and relied on direct intervention in the market to determine the quantity of liquidity, cost of credit facilities extended and the supervision of the banking system was weak. The main focus for the monetary policy is to ensure monetary stability in Jordan and to support the authority's fiscal expansion policies and development plans (Maziad, 2009).

2.2.3 The Post-Currency Crisis Framework

After the currency crisis in 1989, the authorities had no choice but to call the IMF for a comprehensive debt rescheduling process and initiate a stabilization program (Schlumberger, 2002). The main focus of these programs was to reinstate fiscal policy on a sustainable path by ensuring fiscal discipline and limit the borrowing from the CBJ. These reforms were encouraged by the authorities and allowed the CBJ to develop a market-based comprehensive monetary policy framework. The CBJ have decided to liberalize the interest rates on deposits and on credit facilities in 1990. Further, the CBJ started its efforts for restructuring the banking system by introducing more measures that aims at preserving stability, such as imposing a 15 percent legal reserve ratio on all deposits (Maziad, 2009).

Several monetary policy tools followed the liberalization of the interest rates in order to influence the market interest rates indirectly. Some of these tools such as the Re-Purchase Order Agreements (REPO), which was established in the early 1970s, were used in in the pre-crisis era as a tool for providing liquidity for the banking system, not to influence interest rates as they were determined directly by the CBJ. In 1992, the CBJ introduced a new tool to absorb excess liquidity at the banking system by accepting deposits from commercial banks for a maturity of six months at an interest rate of 4 percent on a yearly basis. The CBJ began an auction system for issuing certificates of deposits in 1993, in order to manage the quantity, maturity, and the distribution of liquidity indirectly, thus the monetary aggregate (M2) became an intermediate target to achieve monetary objectives, and the CDs action interest rates became the operational target for the monetary policy in Jordan (Maziad, 2009; Khachatryan, et al., 2006).

The CBJ launched a new tool in 1998 to manage liquidity in the market on a daily basis, "the window rate", which allowed the CBJ to absorb excess liquidity in the market, and provide a floor for the interbank rate. Thus, moving away from CDs as a main operational target to interbank with the window rate as a floor and the seven day REPO as the upper limit (ceiling). Further, the CBJ has continued his policy to preserve the attractiveness of the Jordanian Dinar by ensuring a spread margin between the JD and USD denominated assets. Prudent monetary policy contributed in restoring confidence and the rebound in the demand for the JD after the uncertainties of late 1998 and early 1999 (due to the pass away of King Hussein in Feb., 1999) (IMF, 2000).

After 1999, the CBJ allowed a continued decline in the CDs yields in order to sterilize the economy from external flows to Jordan and encourage the banks to lend mare facilities to the

private sector in order to stimulate the economy (IMF, IEO, 2005). The efforts of the monetary authorities focused on building reserves buffers to defend the exchange rate peg and continue their reform process. In 2004, the country graduated from the IMF programs, but the authorities continued their efforts in reforming the country and attracting foreign investments to enhance growth through privatizing many state owned companies and opening many sectors in the economy for foreign investors. By decreasing the interest rate corridor width by 125 basis points in May 2007, the CBJ streamlined its interest rate structure and replaced the 7-day REPO facility with an overnight facility to ensure the symmetry with the overnight deposit window. (CBJ, 2008).

In 2009, the spill-overs of the global financial crisis affected negatively the Jordanian economy, due to the weakening demand on Jordanian exports of goods and services, domestic exports declined, and the inflation rate contracted by -0.7 percent. In response to these developments the CBJ decreased its interest rates on its main monetary policy tools in 2009 by one point and half percentage , and by half percentage points in 2010 in order to stimulate the economy and encourage banks to extend more credit to the private sector (CBJ, 2011). Further, the authorities have guaranteed all the deposits at the Jordanian licensed banks for the whole year of 2009 to boost the confidence in the economy.

2.2.4 Arab Spring Monetary Policy framework

Since 2009, the Jordanian economy suffered from series form exogenous shocks that resulted in a deterioration in its fiscal and external accounts. Further, the increased uncertainty and the political instability in many countries in the region has affected negatively foreign investment flows, interrupted trade routes, and heightened the pressures on the government to accommodate a large numbers of refugees in Jordan. These developments resulted in a

deceleration in the real growth rate to reach around 3.0 percent after a registered high growth rates (averaging 6.7 percent during (2004-2009)). Further, the interruption of Egyptian gas pipeline due to sabotages in the Sinai Peninsula, which is used in electricity generation, weighted additional pressures on the government and increased the deficit of the government owned electricity company (IMF, 2012).

The central bank of Jordan in 2012, update the monetary policy framework by introduce a new maturity of REPO (weekly), and established a short-term government securities portfolio that would affect the levels of liquidity on the market (IMF, 2013). In 2012, these tools and the forward forex operations supported the central bank of Jordan to inject the necessary dinar liquidity. As liquidity situations improved during 2013, some of the injected liquidity absorbed by the central bank of Jordan (IMF, 2013). Further, the CBJ reduced the interest rates on monetary policy instruments by 1.25 percentage points for 2013 and 2014.These policies helped to central bank in building up its reserves, which reached around USD 12.0 billion at the end of 2013.

Additional, the amendments to the CBJ and commercial banking laws were approved by cabinet in 2015, which would foster transparency and provided the CBJ with the needed autonomy to practice its main functions more effectively. The banking law amendments included changes on the regulatory framework for corporate governance, and prudential requirements. The CBJ also introduced in early 2015 a new interest rate tool, the "CBJ Main Interest Rate" which would be accredited as a reference point for administering the policy, the main aim of this tool is to act as a reference sign for the banking system for the CBJ intentions and the desired interest rate at the market (CBJ, 2015).

The development in the macroeconomic and legislative environment walked hand in hand with the evolution of the supervisory policies in order to accommodate the changes in the domestic market as well as the increased interdependency between global financial markets. The following section will address the main changes in the supervisory policies and procedures in the banking sector.

2.3 The Developments of Supervision Policies and Procedures

The supervision over banking activities has developed in parallel with the advancements and innovations in the banking industry as well as the evolution of the monetary policy frameworks. Authorities tried to preserve monetary stability through insuring the soundness of the banking system and the existence of good corporate governance. Many regulatory measures have been administered to banks as a mean for ensuring the viability of the banking sector. This section will discuss briefly the main developments with regards to supervision in banks and some of the main measures and announcements that shaped the relationship between the regulatory authorities and the banking sector in Jordan.

The regulatory authorities since the early 1970s till the commencement of the liberalization process in early 1990s have influenced the interest rates in the market directly. Further, the supervisory authorities have intervened directly in the way that banks manage their own balance sheets through introducing multiple restrictions on extending credit to the private and the public sectors and setting the limits for liquidity and credit concentration ratios. These restrictions included, for example, accepting deposits in foreign currencies from non-residents, setting limits on extended credit facilities to total deposits, so that it should not exceed a pre-specified percentage, and limits on credit growth and as a percentage of their capital (CBJ, 1969: 1989). These restrictions were employed to serve the overall goal of the central bank as

its operational targets were quantitative in nature which resulted in a heavily influenced banking sector by the central bank.

The economic crisis in 1989 have paved the way for a more autonomous central bank and market-oriented reforms were interest rates are determined according to market forces. The supervisory authorities have adopted to these changes through monitoring the bank performance indicators and reduce restrictions on banks liquidity management, were they are responsible for managing their balance sheets and activities within the set guidelines by the central bank. These measures have been taken during 1993 to initiate the commencement of the indirect policies of influencing liquidity in the market through stopping the acceptance of licensed banks' deposits at the CBJ, allowing banks to manage their clients' portfolios in foreign currencies, and issuing certificates of deposits in domestic and foreign currencies to their clients (CBJ, 1993).

Further, the supervisory authorities have set the main guidelines for managing commercial and Islamic banks' portfolios in foreign currencies to ensure the stability in the banking sector through setting limits on the levels of investments, diversification, and rating of the investment tools (CBJ, 2000). Also, they set new rules for the level of credit concentration and contributed in drafting the electronic transactions law to keep up with the innovations in the banking industry (CBJ, 2001).

The supervisory authorities sought to enhance the financial position of Jordanian banks through adopting these measures and raising the minimum capital requirements, setting an early warning system, and applying corporate governance instructions that complies with international standards and practices. Furthermore, there should be a certain organizational and

administrative framework under which responsibilities and authorities are clearly set and well specific to ensure effective supervisory frameworks (CBJ, 2012).

As for financial and regulatory indicators, the CBJ has implemented Basel II standardized approach to calculate Capital Adequacy Ratio (CAR) since the year 2008 though the CAR level is well above the set 8 percent by the Basel committee (CBJ, 2012). Moreover, the supervisory authorities are in the process of implementing Basel III requirements to enhance liquidity management and solvency.

In 2016, Central Bank of Jordan (CBJ), issued a new guideline for stress testing of banks operating in Jordan these came after the Basel Committee on Banking Supervision in 2009 issued the main principles of stress testing and supervision. In 2012, the Committee issued a paper on the review of the application of the supervisory authorities to these principles, which are based on the stress testing practices and supervision that are released after the global financial crisis (BIS, 2009). In addition, the IMF has developed comprehensive methodologies for conducting these tests. The Central Bank issued these guideline and instructions in order to keep pace with the latest developments in this regard and in line with international best practices in particular.

Stress tests are used to identify the risks facing the bank, to assist in capital planning and to help manage liquidity. Compression stress tests are a complementary tool to other risk management tools and are not a substitute for them. The CBJ explained the role of the board of directors and senior executive management in the stress tests process. For the board has to ensure that there is an effective framework for stress testing and high-risk management. The board has ultimate responsibility for the bank's stress test program and should ensure that the risk management department conducts periodic stress tests and that the board has a key role in

the adoption of the hypotheses and scenarios used and analysis of the results of tests and the adoption of actions to be taken based on these results. While, the role of the senior executive management is to implement and monitor the stress-testing program, and insure that a qualified staff is available and have the appropriate tools and methods to conduct stress tests as well as using the results of the stress tests to determine and assessing the bank's risk tolerance and planning process of capital and liquidity (CBJ, 2017). Stress tests are approved by the board of directors and are documented in an appropriate manner. The documentation process includes the type and details of the stress tests and the scenarios used, the assessment of the basic hypotheses on which the tests were built at least annually, the periodicity of the implementation of stress tests and corrective actions Type and test results. The stress-testing program should include quantitative and qualitative methods to improve the comprehensiveness of these tests and to make them supportive and complementary to the risk management models and methods used by the bank, and the banks should consider two types of tests under the stress test, the sensitivity tests and scenario analysis tests (BIS, 2019).

Sensitivity analysis tests are used to measure the impact of movements in risk factors - each individually - on the financial position of the bank. The relationships and overlaps between different risk factors are not considered. Therefore, the objective of these tests is to determine the sensitivity of the bank's financial position to one risk factor and to assess the bank's ability to address it. The scenario tests these tests are designed to assess the impact of probability scenarios that may be low but their impact on the financial position of the bank is significant, including tests based on historical events, and hypothetical tests that may occur. The internal audit department is responsible for at least annual review and evaluation, and the results of evaluation and review should be submitted to the board of directors (BIS, 2009). The banks should use the results of stress tests to develop contingency plans to deal with different

risks and activate the use of risk mitigation instruments such as hedging. Stress tests cover all complex financial products as needed and include assessing the extent and impact of off-balance sheet assets on other risk types, especially credit, market and liquidity risks and their influence on the bank's solvency and liquidity. Central bank will assess the framework of stress tests conducted by banks on a regular and comprehensive basis. The tests used should be proportionate with the degree of risk appetite identified by the bank, so that the chosen scenarios are commensurate with the size, nature and complexity of the bank's business and the risks associated with it (BIS, 2019).

During all these stages the CBJ pursuit the development of the supervision in order to safeguard the banking system in Jordan through protecting the rights of the depositors and the shareholders. The supervision of the banking system in Jordan takes two forms; off-site supervision , where the supervision team monitors banking operations, periodic analysis of financial statements and periodic reports sent by banks to CBJ, as well as reviewing requests for licensing of fresh banks and branching Jordanian banks in Jordan and overseas (CBJ, 2012). While on-site supervision includes field visits to guarantee adherence to banking law, CBJ’s regulations and the evaluation the internal control system and management quality.

2.4 The Development of the Jordanian Banking System in a Regional Context

During the last decade, many countries in the MENA region have started to implement many structural reform programs. The financial sector in general and the banking sector in particular, was not isolated from these reforms, which were directed towards preserving the stability of the financial system in these countries. The speed and the magnitude of these reforms differed between the MENA Countries, which resulted in a deferent characteristic of the banking industry in these countries. The actions and policies that followed the attitude of

these banks have been affected by the regulatory and political developments in MENA (Abed & Davoodi, 2003).

Many performance metrics could show how banks manage their resources in these countries. For example; the effectiveness and the ability of the banking sector, represented by the evolution of return on their assets ratio, which have been relatively high compared to other countries in the MENA area despite the higher ratio of non-performing loans in these countries[3] (Algeria, Saudi Arabia, Lebanon, and UAE), which could be attributed to factors that the banking industry have little control over.

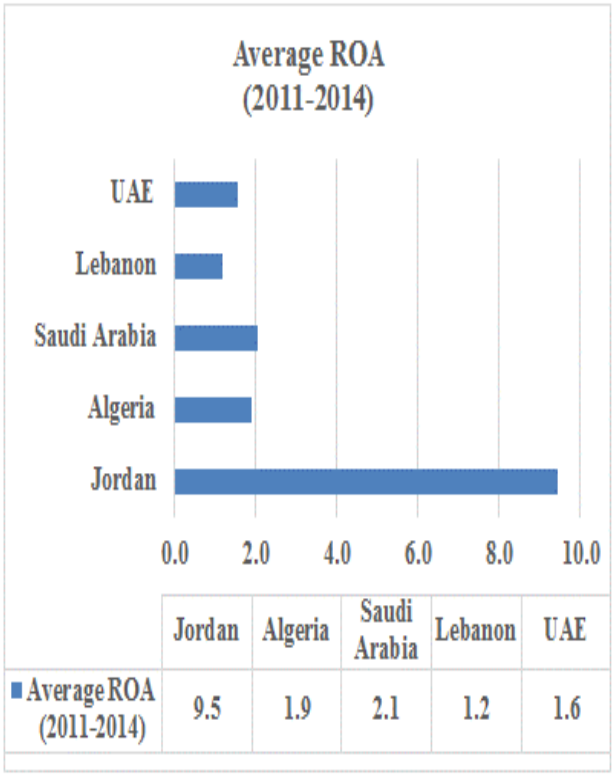
In addition, the conservative attitude of commercial banks in Jordan is considered one of the main features of the banking system as reflected in the return on equity ratio. Safeguarding the shareholders equity compared to other countries (Algeria, Saudi Arabia, Lebanon, and UAE) due to the political instability of the neighbouring countries and the reliance of these banks on traditional banking services to generate profits.

The conservative approach for Jordanian banks and the high liquidity levels in the banking system validates the ability of these banks to a higher level of exposure and meets its obligations (Almumani, 2013).

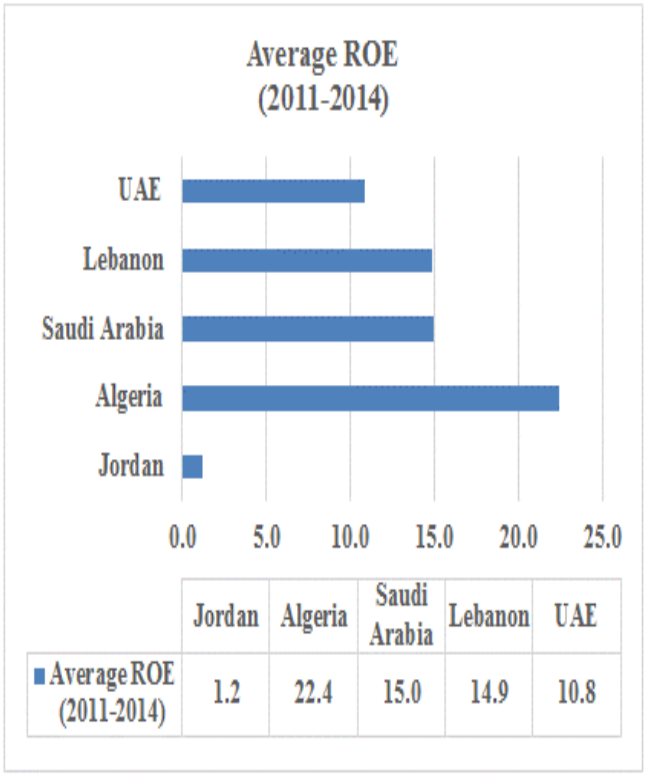
The interest margin to gross income express the value of the banks activities in grants loan and accepted deposits, the Jordan had the high percentage in MENA region as shown in figure1. Which illustrate the traditional image of the banks in maximise the spread between the interest that paid and the interest that got from loans.

[3] The researcher have selected these countries according to data availability, as many banks and countries in the MENA region do not publish data in an accurate and timely manner.

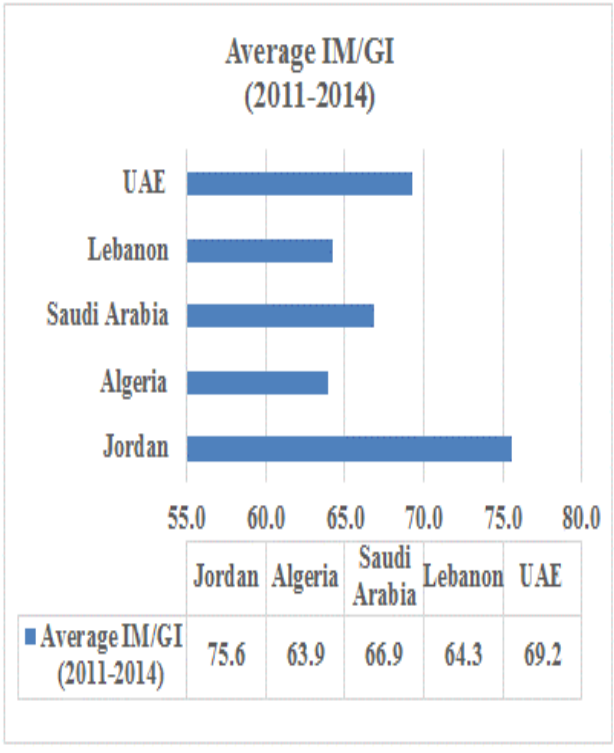
Figure 1: Main performance metrics of selected countries in the MENA region



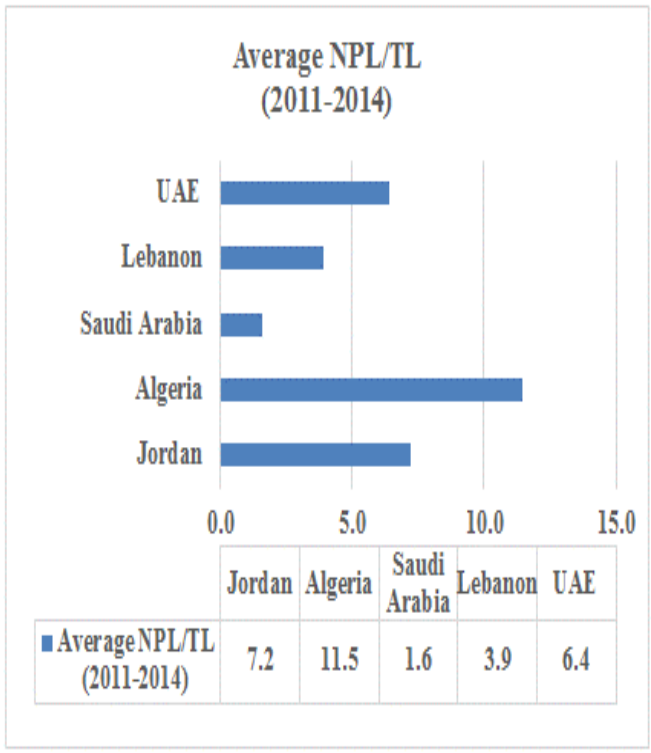
	Jordan	Algeria	Saudi Arabia	Lebanon	UAE
Average ROA (2011-2014)	9.5	1.9	2.1	1.2	1.6



	Jordan	Algeria	Saudi Arabia	Lebanon	UAE
Average ROE (2011-2014)	1.2	22.4	15.0	14.9	10.8



	Jordan	Algeria	Saudi Arabia	Lebanon	UAE
Average IM/GI (2011-2014)	75.6	63.9	66.9	64.3	69.2



	Jordan	Algeria	Saudi Arabia	Lebanon	UAE
Average NPL/TL (2011-2014)	7.2	11.5	1.6	3.9	6.4

- Source: Central Bank of Jordan and the IMF
- IM/GI represents the ratio of interest Margin to gross income
- NPL/TL represents the ratio of Non-performing loans to total loans

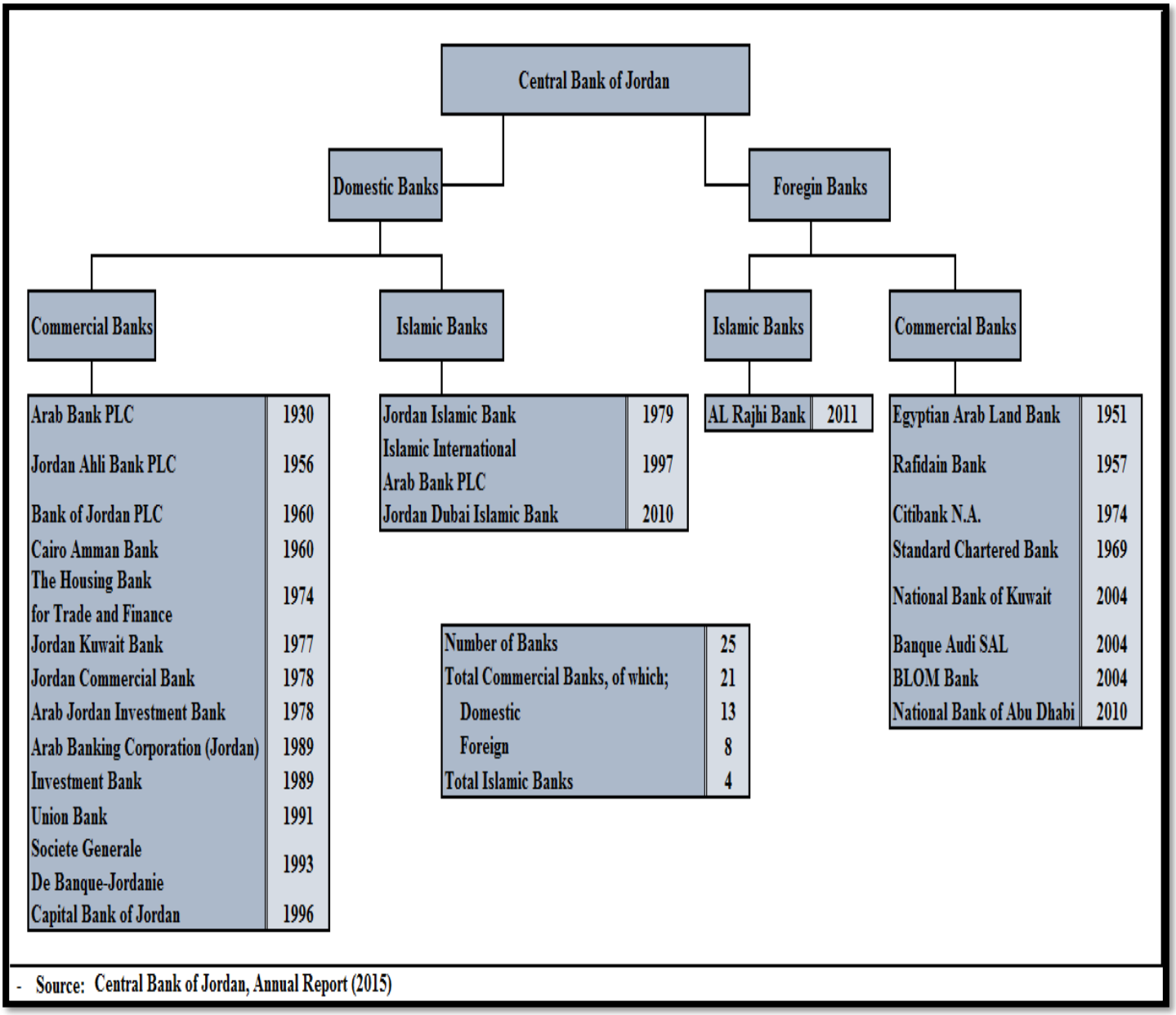
The figure above shown the non-performing loans to total loans in Jordan is high comparing to other MENA countries (UAE, Saudi Arabia, and Lebanon) except in Algeria it has high than Jordan. Which indicated that Jordan involved with high risks toward the non-performing loans. The higher ratio of non- performing loans could be attributed to the macroeconomic situation in Jordan and the conditions regarding the illiquidity degree of the market. The conservative attitude of commercial banks in Jordan shown in most of the ration above in figure 1.

2.5 Branching Evolution of the Banking System in Jordan

The massive evolution, which stated since the early 2000s increased the importance of this sector, as it is considered one of the key pillars supporting the Jordanian economy. It comprises 25 operating banks, of which 16 Jordanian banks, 3 Islamic banks and 9 branches of foreign banks, of which one is an Islamic bank. These banks work via a 785-branch network and 82 official offices. The population index therefore reached 12,1 thousand people per branch, for the total number of branches (CBJ, 2015).

The market is arguably saturated; nonetheless, the banking industry is relying on traditional services, and therefore a wide range for expansion opportunities is still available (Almumani, 2013). Further, the development in the outstanding balance of assets have accelerated dramatically by more than three fold since early 2000s, to reach around than USD 66.4 billion at the end of 2015. In addition, total deposits, domestic time deposits, and credit facilities of licensed banks increased intensely, reflecting a sound growth and the rise of its importance to financial and economic development.

Figure 2: The Banking system in Jordan (End of 2015)



2.6 Soundness Indicators

The soundness of the banking system can be noticed by examining the soundness indicators such as the Capital Adequacy Ratio (CAR), which was at 19.06%, high above the regulatory requirements set by the central bank and the Basel committee at 12% and 8%, respectively. Moreover, the coverage ratio for Non-Performing Loans (NPLs) witnessed a steady rise during the last few years, reaching 74.7%. In addition, customer deposits witnessed

a healthy growth rate, averaging 10.3% during the period (2004-2015). On the other side of the balance sheet, credit facilities grew on average by 13.3% during the same period. Thus, impacting the average growth level of balance sheet (assets and liabilities) during the period (2004-2015) by 10.0% and 8.2%, respectively. The continued growth in both sides of the balance sheet sign for the strength in Jordanian banking system.

Table 1: Financial soundness indicators

Item	2004	2015	(2004-2015)
Capital adequacy ratio	17.8%	19.06%	19.2%
Non-performing loan/Total loans	10.3%	4.9%	6.51%
Growth in facilities	19.3%	9.6%	13.3%
Growth in customer deposits	15.9%	7.7%	10.3%
Coverage ratio	63.8%	74.7%	67.4%

- Source: Central Bank of Jordan database

2.6.1 Developments in the Assets

The importance of the banking system in the Jordanian economy could be well presented when taking a glance at the ratio of total assets to the GDP. This percentage has reached on average 197.2 percent during the period (2004-2015). Though, it declined on a steady basis from 220.3 percent in 2004 to 176.9 percent in 2015, it still demonstrate the importance of ensuring the resilience and viability of the banking system and illustrates the need to for strengthening internal and regulatory control systems through effectively managing the both sides of their balance sheets.

The developments in the balance sheet of the Jordanian banks was influenced by multiple dynamics that impacted their management as well as their operational framework, which in

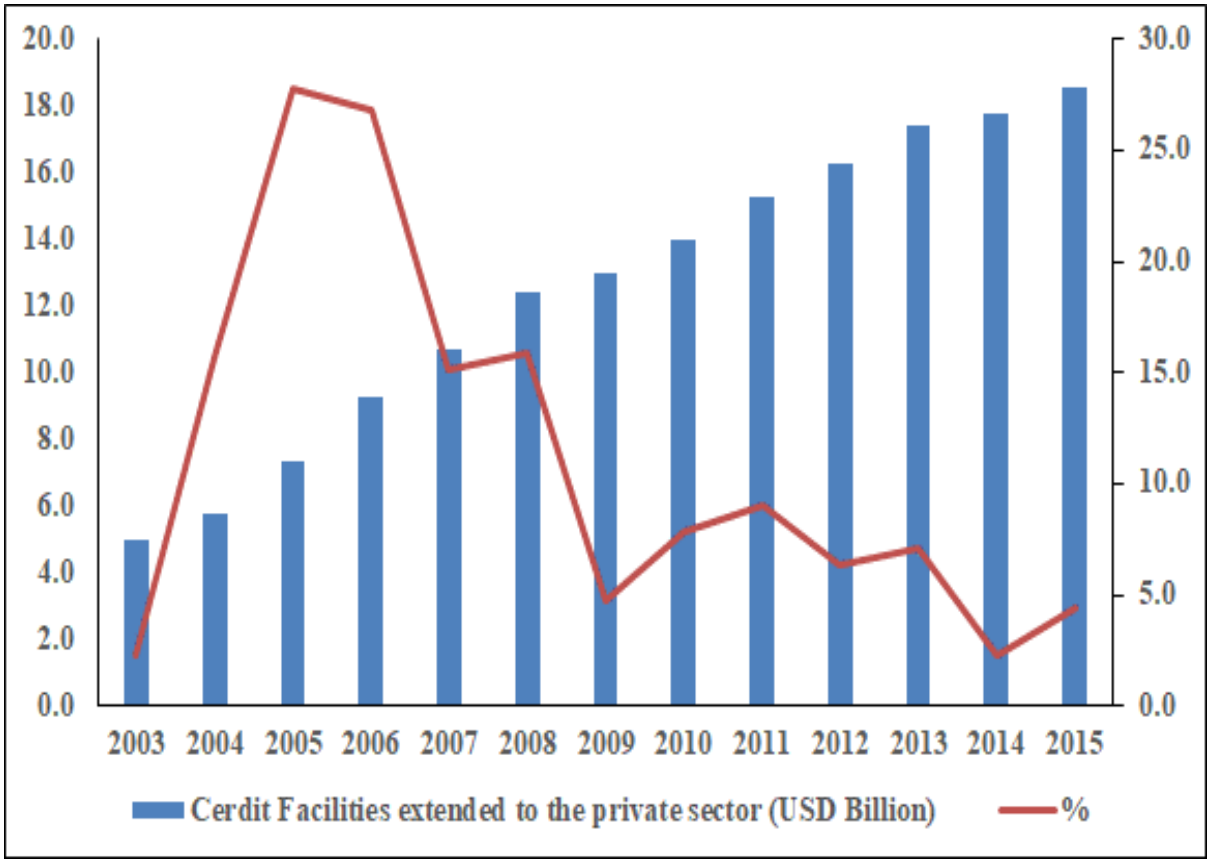
turn affected the dynamics of the balance sheet at these banks. The growth in the assets have been mainly driven by the growth in the credit facilities as it is considered one of the main Items in the consolidated balance sheet. Extending credit to public and private entities have also been affected by the business doing environment in the country.

Changes in total assets during the period (2004-2015) were mainly influenced by changes in domestic assets, which include claims on the public sector. This item increased at a steady pace of 21.6% on average during the period under consideration. The steady rise in the government deficit, especially after the global financial crisis have increased the percentage of government securities owned by commercial banks in Jordan as a result of the government heavy reliance on internal borrowing through issuing securities and bonds to finance deficit.

The claims on public sector as a share of total assets increased from 8.8 percent in 2004 to 24.4 percent in 2015. Nonetheless, these developments did not affect negatively the structure of the assets backed by a good capital base and a strong liquidity position. Further, government securities and guaranteed debt is considered as a risk free investment with reasonable return.

The structural reforms adopted by the government to strengthen the fiscal position did not resolve the persistent deficit in its budget, therefore, their reliance on internal borrowing through issuing bonds and treasury bills continued. Accordingly, limiting the available funding for the private sector and increasing its costs. The impact of the government structural reform programs as well as their efforts to privatize public companies impacted the changes in extended credit to the private sector as well as the macroeconomic environment in the country.

Figure 3: Evolution of credit facilities extended to the private sector (2003-2015)[4]

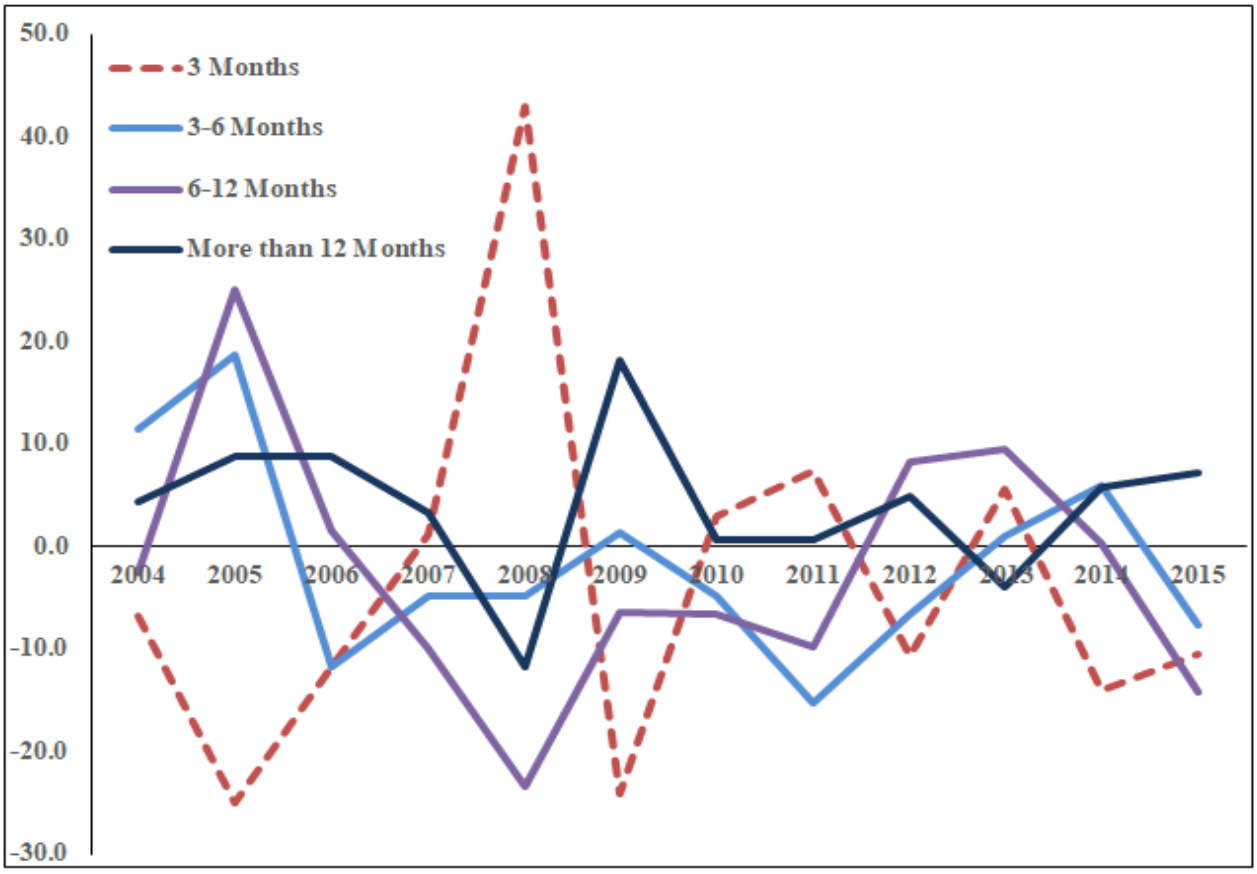


The growth of extended credit facilities to the private sector have increased dramatically since 2003 due to the repercussions of the Iraqi war effects and the near completion of structural reform programs by 2004. Credit facilities afterwards increased by around 20.3 percent on average for the period (2004-2008) as the economy have begun to reap the fruits of reforms, the large capital inflows to the Jordan form the GCC countries, and the establishment of several business entities by Iraqi investors fleeing from political instability in the neighbouring country.

[4] Source: Central bank of Jordan and author's calculation.

The impact of the global financial crisis on the Jordanian economy transpired through multiple indirect channels. These factors impacted the macroeconomic conditions in the country as well as the risk appetite of investors. In addition, banks started to limit the extended credit to new investments which resulted in a decline in the average growth rate of domestic credit, reaching 4.7% in 2009. Moreover, the geopolitical unrest in the region that coincided with the Arab spring heightened the uncertainty of the economy as well as the financial system, which resulted in a slower pace of growth in credit, averaging 6.2% for the period (2010-2015).

Figure 4: Change in the term structure of assets to total Facilities



- Source: Central Bank of Jordan
- Data in the Graph represents the percentage change of the term structure of loans and advancements and Discounted bills to total facilities

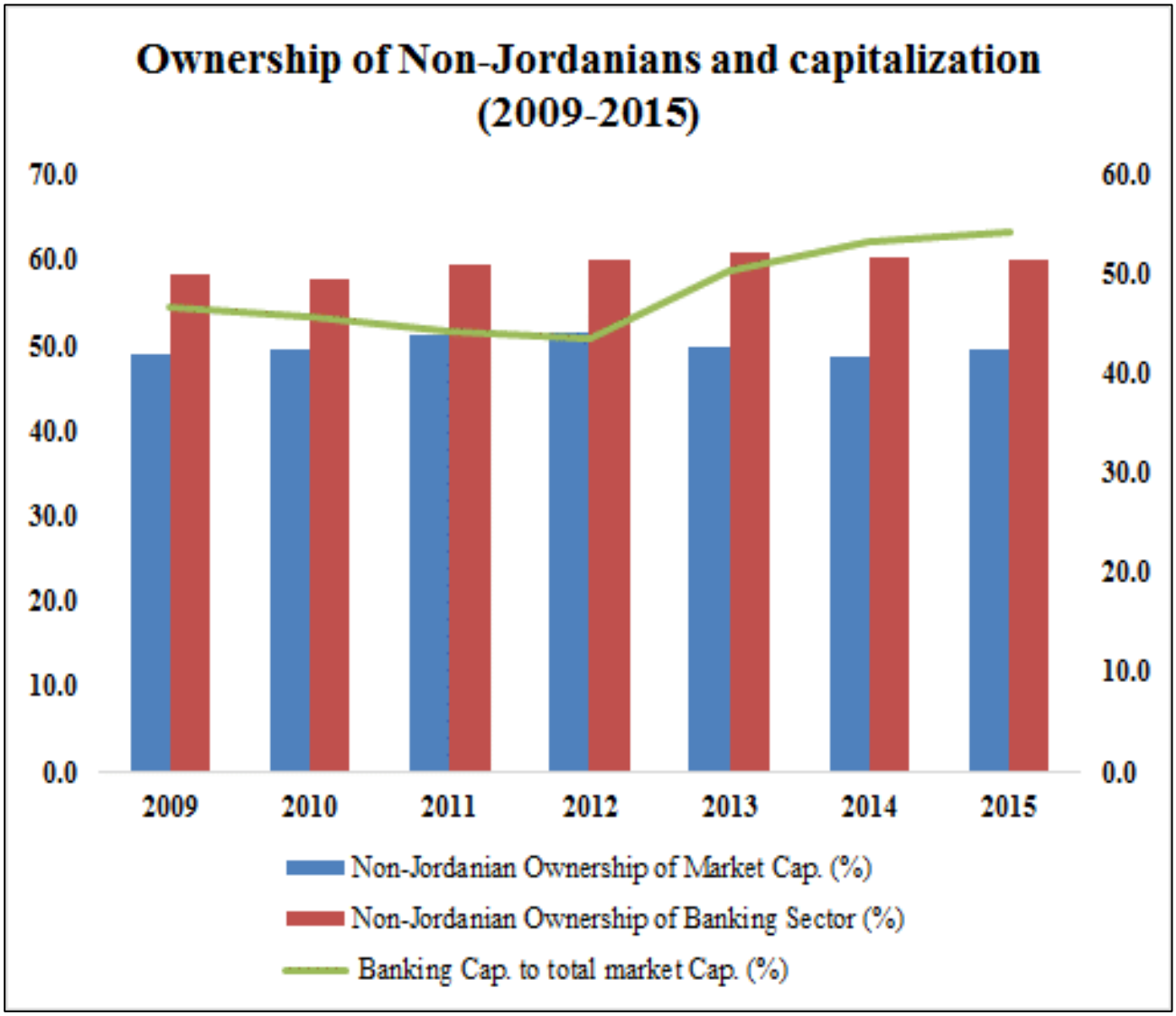
Loans and Advances and discounted bills constituted around 82 percent, on average, of total credit facilities extended by licenced banks in Jordan during 2004-2015. The term

structure of these facilities have changed gradually during the last decade towards focusing more on long term facilities, which shows that banks in Jordan are constantly changing and adapting their positions in the domestic markets to mitigate risk and adapt to the current market conditions.

Facilities with three-month duration have been more volatile during the period (2004-2015), with a standard deviation of 16.8 points, which reflects the variability in these facilities and the effect of various factor on its balance. On the other hand, assets with more than 12-month duration has been less volatile thought the period under consideration. The reason behind that could be referred to the characteristics of facilities terms under different durations and the effects of market conditions and the macroeconomic cyclicality on their volumes.

The banking industry in Jordan has been keener to change the term structure of the extended facilities through moving gradually away from short term lending and increase their position in long-term facilities. The 3-month duration facilities have decreased from 34.6 percent of total facilities in 2004 to 20.2 percent in 2015, whereas facilities with a duration more than 12 months have increased from 43.7.0 percent in 2004 to 64.4 percent in 2015, other duration from 3-6 months and 6-12 months have been less volatile and held their positions throughout the period (2004-2015). These changes reflect the overall approach that the banking industry have adopted to manage their risks and their positions in the market. Indeed, the increase in long term lending could be realized through the decline of risk appetite due to the geopolitical instability in the region. This approach has compelled banks to build their asset management frameworks toward searching for less risker investors, which would explain their inflated portfolios of government securities and real economy projects that will have the ability to pay-off its obligations and contribute in real economic growth.

Figure 5: Ownership of non-Jordanians, capitalization of banks in the ASE

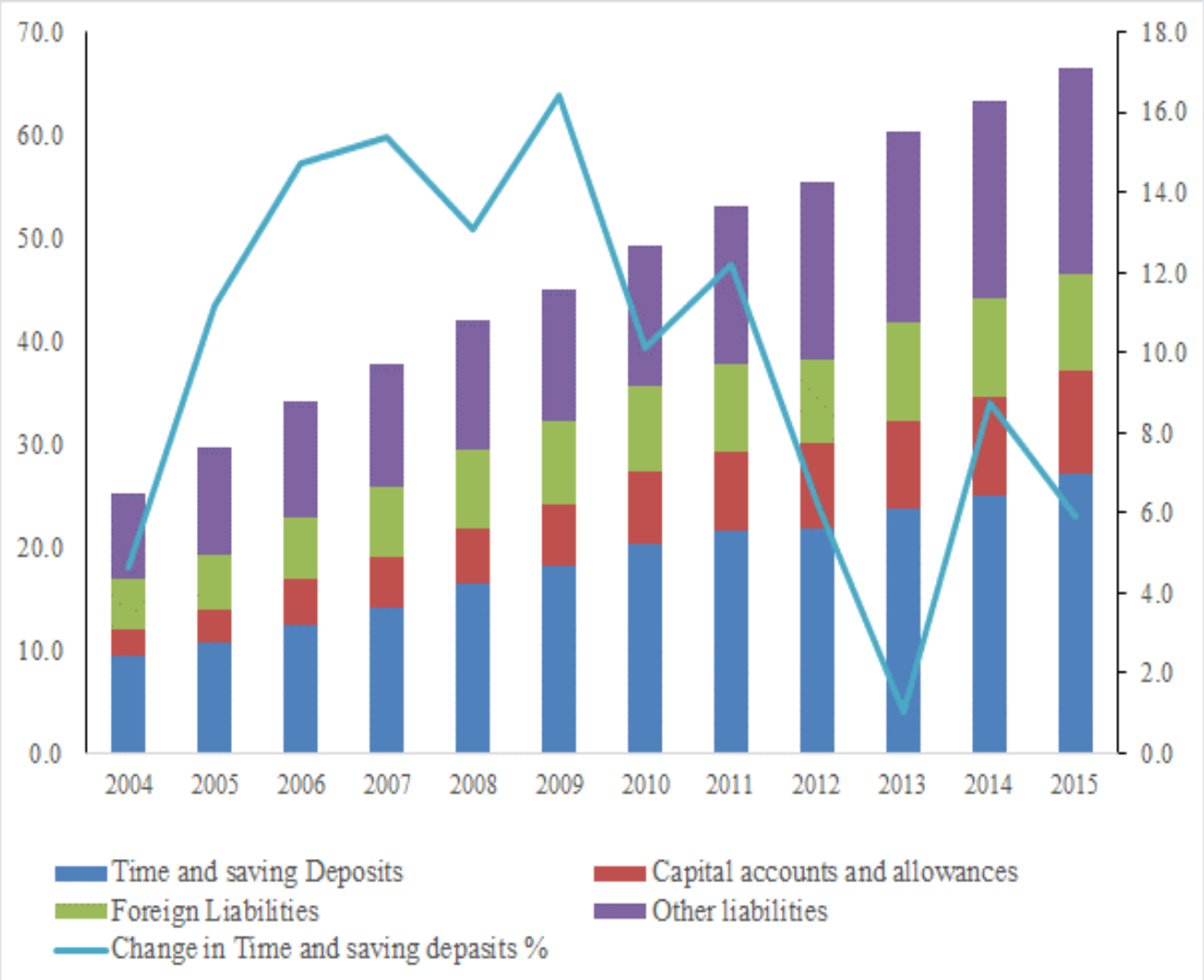


However, the domestic market conditions have been affected by the ongoing turmoil in the region and the global financial situation, the banking sector is still considered a major part of the Amman Stock Exchange (ASE). The capitalization of the banking sector constitutes around 54.2 percent in 2015, which reflects the importance of this sector to the Jordanian economy. The resilience in this sector attracted long-term investors to this sector as illustrated in the stability of foreigner's ownership in banking market capitalization compared to the relative volatility of the non-Jordanian ownership in the total market capitalization.

2.6.2 Developments in Liabilities

The funding sources for banking activities in Jordan comes from deposits as it is considered one of the main components of liability structure of the Jordanian balance sheets. The ratio of deposits to GDP, which is considered as a proxy for the development in the use of funds, have averaged around 105.4 percent during the period (2004-2015) which reflects a high size of the banking sector and its ability to affect the real economy.

Figure 6: Liabilities composition in USD billion (2004-2015)[5]



[5] Source: Central bank of Jordan and author's calculations.

Another major component of the balance sheet contributed to the development in the banking filed. Labilities shows the funding sources that commercial banks use to finance their operations in Jordan. The main component of liabilities is customers' deposits, which constitutes more than 60.0% of total assets. Furthermore, time deposits constitutes that majority of the private sector deposits and a big part of total liabilities, averaging around 50% of liabilities during (2004-2015).

The change in the structure of total liabilities have changed considerably during the past decade. Capital and allowances have increased noticeably by 20.2 percent and 41.3 percent, respectively, during (2005-2006) as banks have tried to strengthen their capital base. The growth in time and saving deposits have witnessed a steady increase, but the repercussions of the global financial crisis and the increased uncertainty in the region have decelerated its growth rate, especially in 2012 when it reached 1.0 percent.

Nonetheless, time deposits are considered one of the major sources of funding for Jordanian banks. However, other items such as foreign liabilities have remained relatively stable throughout the period under consideration constituting around 16.8% percent of total liabilities throughout the period under consideration. Deposits of the private sector constitutes a major part of total deposits of the banking system, attained on average 90% during (2004-2015). As for the currency composition of deposits, private sector deposits in foreign currency have took a downward trajectory from 37.8 percent in 2004 to 21.2 percent in 2015 which reflects the increased confidence in the national currency.

The commercial banks in Jordan relies on customers' deposits as a main source of funding. The loan to deposits ratio was at 65.5%, on average for the period (2004-2015). With some exceptions that is related to macroeconomic conditions, were it rose well above the average

due to the growth of extended facilities to public entities (guaranteed debt). Further, capital adequacy ratio as it reached 19.6 percent at the end of 2015.

2.6.4 Market Concentration

The level of concentration in the market is considered one of the important elements that reflects the competitive power amongst banks and a useful tool for screening the market structure (Rhoades, 1993). The Jordanian economy is arguably saturated with regards to the number of operating banks in Jordan (Almumani, 2013). Since the early 2000s a number of new entrants have increased the degree of competitiveness in attracting deposits and lending facilities for various sectors, but the level of concentration is still high when taking into consideration that the Arab bank (ARBK) and the Housing Bank for Trade & Finance (THBK) denominates the banking industry in Jordan.

Many studies have highlighted the effects of concentration in the banking industry. For example, De Nicolò & Loukoianova, (2007) found that bank risk decreases a less concentrated markets, while Keeley, (1990) found that the surge of competition after the relaxation of state restrictions in the U.S. during the 1980s decreased monompoly power and increased bank faliures. Thus, the regulatory authorities have to strike the right balance by monitoring the market and ensure the comply with the set regulations to ensure the stability of the banking sector.

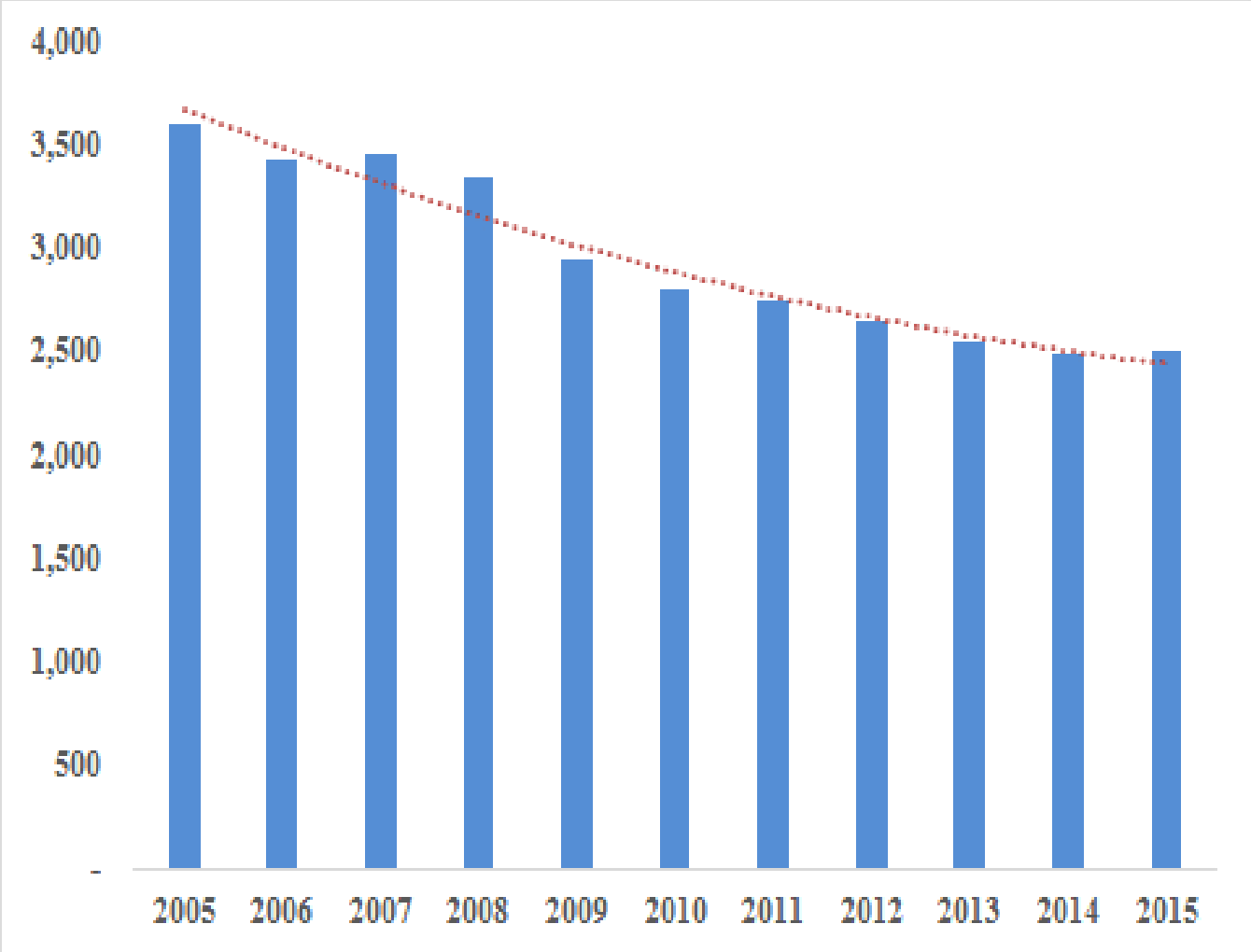
2.6.3 Hirschman-Herfindahl Index

The Hirschman-Herfindahl Index (HHI) index is the most common statistical measure of concentration. It focuses on the relationship between market structure and bank's performance and takes into account the number of banks that constitutes the market by calculating the market share of all banks in the markets and summing the squares as follows:

$$HHI_i = \sum_{i=1}^{n} (MS_i)^2 \quad (1)$$

Where HHI_i the Hirschman-Herfindahl Index, MS the market share for the banks at the i^{th} year, and n represents the number of banks in the market.

Figure 7: Development of HHI for banks assets[6]



The researcher have calculated the HHI index for the total assets, and for gross loans and total deposits as a measure of banking industry competition in Jordan in order to determine the

[6] Source: Bankscope database and author's calculation.

level of concentration in the market on both sides of the balance sheet and their effects on banks' profitability metrics. Bankscope data was employed in order to get individual bank data levels for the period (2005-2015).

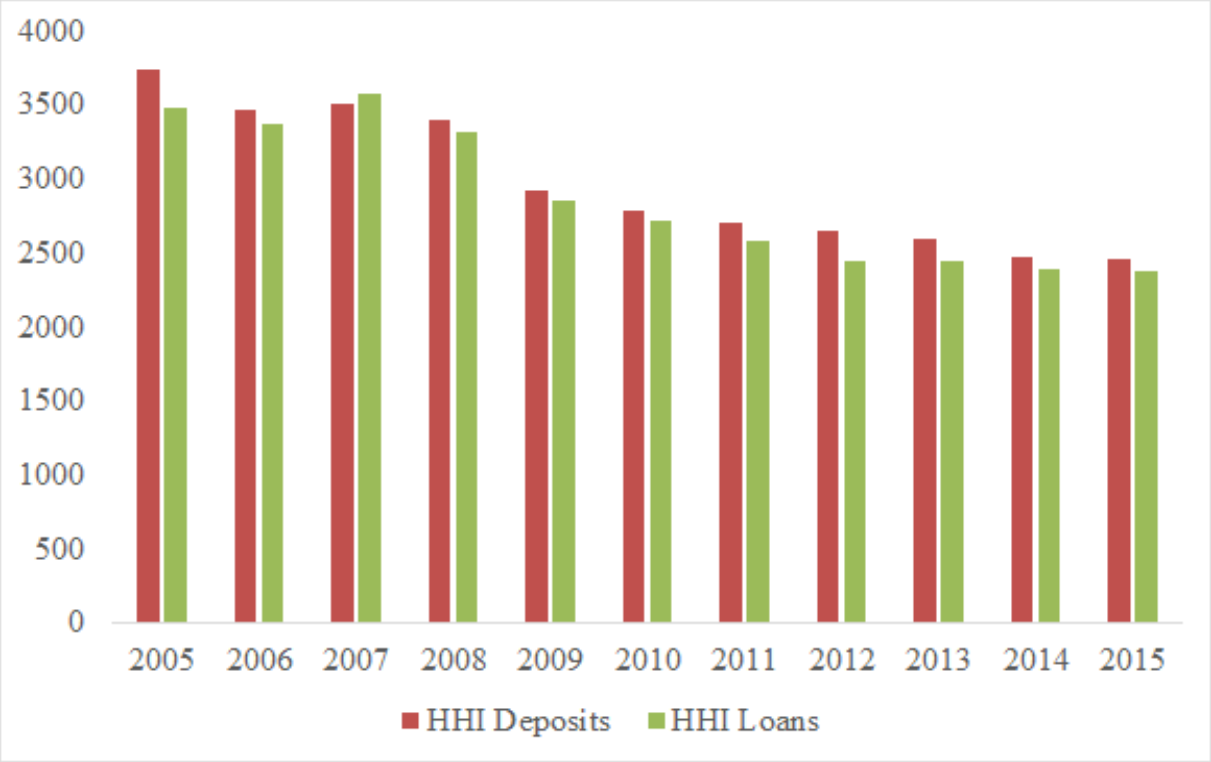
The banking industry in Jordan is a relatively small compared to other markets in the region. Though the number of operating banks is considered large, a relatively high level of concentration in the market share of assets exists when measured by the HHI. The level of concentration, measured by the market share of total assets took a downward trend since 2005 due to new market entrants, mainly foreign banks, such as National Bank of Kuwait (NBK), National Bank of Abu Dhabi (NBAD), and BLOM bank. Further, two Islamic banks have entered the markets in 2010 (AL-Rajhi bank) and 2011 (Jordan Dubai Islamic bank).

Also, the downward path for HHI assets from (3,598) in 2005 to (2,502) in 2015 have been affected by various factors that is related to the macroeconomic conditions domestically as well as in the region and the global financial crisis, which took its tool in Jordan since 2009. Though the trajectory of HHI is have been decreasing overtime, it is still a little high as one bank is controlling around 45 percent of total assets of the banking sector, which sheds the light on the role of the regulatory authorities and its role in preserving stability and ensuring the viability of the banking sector.

Further, market competition have increased during the past decade as the HHI index for both deposits and gross loans witnessed a parallel decrease during the period under consideration from 3,745.5 points and 3,480.8 points in 2005 to 2,461.9 points and 2,373.5 points in 2015, respectively. The individual data reveals that their market shares of gross loans to total deposits are close for most of the commercial banks with some differences as some banks are more conservative in seeking a higher market share of deposits to gross loans. These

differences reflects the variance in managing their balance sheets and different performance metrics targets.

Figure 8: HHI index for deposits and gross loans[7]

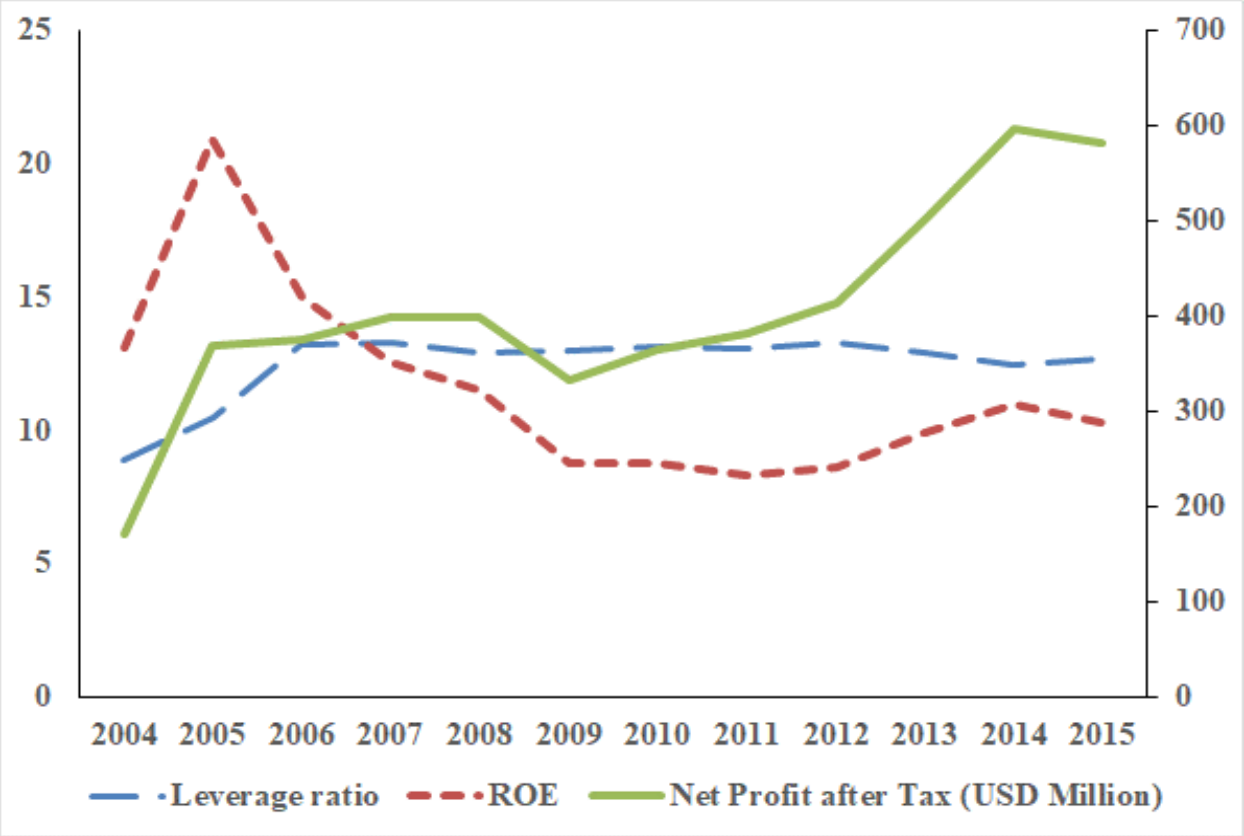


2.6.5 Profitability

Obtaining fair earnings that ensures the viability of a firm is essential for maintaining ongoing activity. The European central bank defined the bank performance as the "*capacity to generate sustainable profitability*" where the main drivers of profitability are earnings, efficiency, risk-taking and leverage (ECB, 2010). The banking sector in Jordan is considered one of the highest banking sector (MENA) with an adequate level of liquidity and high level of profitability coupled with a strong capitalization (CBJ, 2014).

[7] Source: Bankscope database and author's calculation.

Figure 9: Main Performance indicators[8]



Variables in figure 9 shows that banking profitability rose in a continuously since 2004, except for 2009, as they were impacted by the global financial crisis as well as the domestic economic environment, though profitability ratios, such as ROE, declined since 2006 as banks increased their capital. On the other hand, the leverage ratio was relatively stable indicating a high reliance on private capital for financing operations. The major source of revenue was from extending credit to their clients. It is worth noting that interest margin to gross income was more that 60% during the period (2004-2015). Moreover, the ROA was low during the period showing that some resources are not allocated efficiently.

[8] Source: Central Bank of Jordan database and author's calculation.

Many factors impact profitability at banks, favourable macroeconomic factors tends to raise banks profitability. Moreover, the market structure and the concentration level impacts profitability. Many studies found that market concentration is associated with increased profitability (Kupiec & Lee, 2012). But these factors are dependent on the level of risk-taking and the adopted policies of balance sheet management. For example, the cost to income ratio which is considered relatively high for the Arab bank (49.3 percent) taking into consideration its market power as it controls around 49 percent[9] of the total assets in the banking industry for the period (2005-2015).

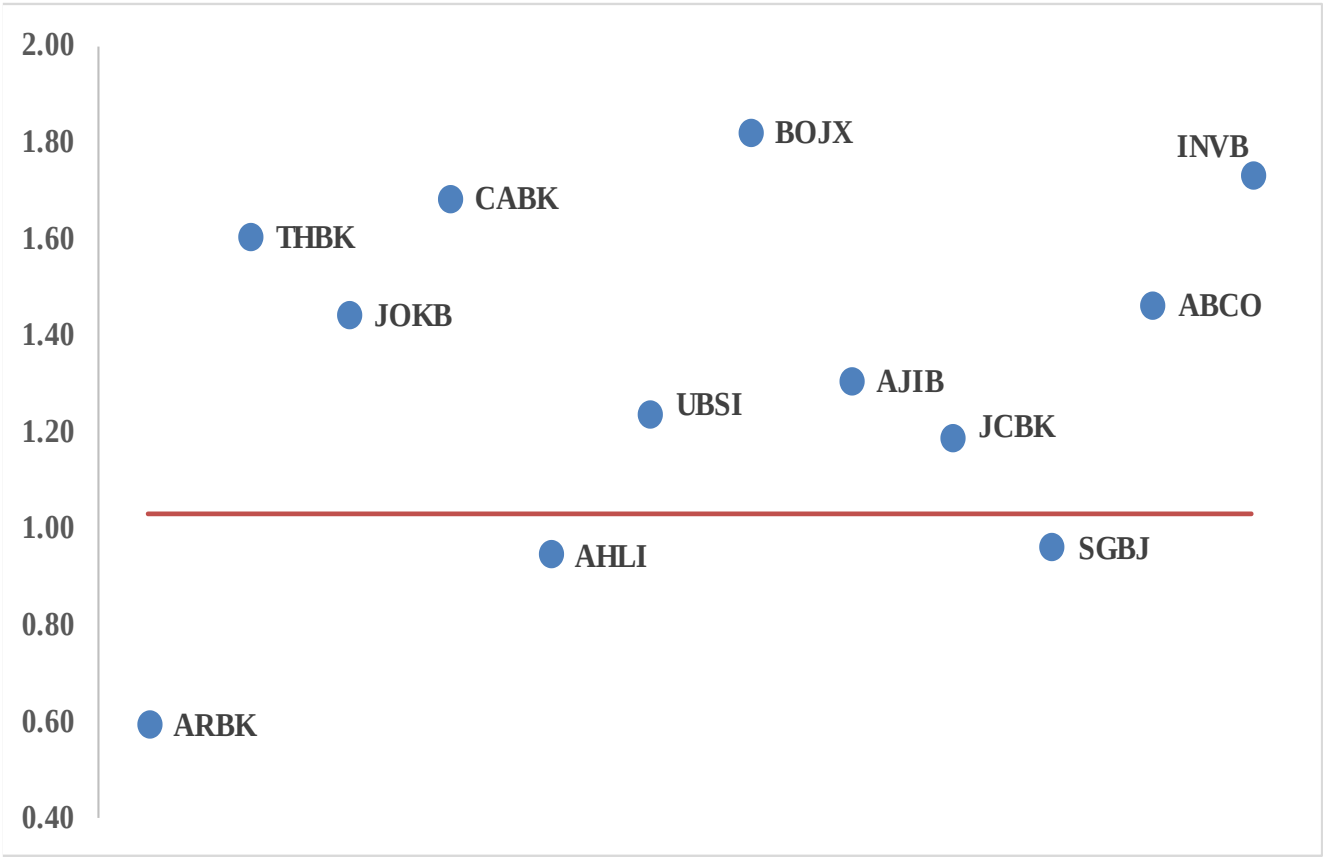
Jordanian commercial banks prudence has impacted their profitability which was low during the period (2004-2015), though stable. The researcher has calculated the average ROAA for the banks weighted by its assets size. Most of the banks are above the industry average (1.03 percentage points) with the exception of the Arab bank, Ahli Bank and Société générale de Banque-Jordanie which reflects that resource allocation management is relatively efficient. As for the Arab bank, the prudent manner of managing and allocating its resources is reflected on the return on asset ratio, which highlights that it could increase its profitability by increasing its exposure and preserve its soundness at the same time.

Serious challenges face the banking industry due to the geopolitical tensions in the region as well as the innovations in financial products which changed the way managers perceive risk and stressed the importance of balance sheet management. These developments have placed liquidity management at the heart of the banking core responsibilities. Thus, several methods

[9] Source: Bankscope and authors' calculations.

and tools have been developed in order to effectively manage liquidity in banks and charting managers' decisions towards preserving the viability and stability of banks.

Figure 10: ROAA for selected commercial banks in 2015[10]



Source: Bank scope data base abd author's calculations

Arab Banking Corporation (ABCO), Jordan Ahli Bank Plc (AHLI), Arab Bank Plc (ARBK), Arab Jordan Investment Bank (AJIB), Bank of Jordan Plc (BOJX), Cairo Amman Bank (CABK), Invest Bank Jordan (INVB), Commercial Bank (JCBK), Jordan Kuwait Bank (JOKB), Société générale de Banque-Jordanie (SGBJ), Housing Bank for Trade & Finance (THBK), Bank al Etihad (UBSI).

2.7 Basel accords and Liquidity Risks

The survival of banking institutions in the current financial system depends mainly on its ability to meet its contractual obligations by ensuring the availability of cash or collateral to

[10] Source: Bankscope database and author's calculations.

fulfil those needs at the appropriate time by coordinating the various sources of funds available to the institution under normal and stressed conditions (Federal Reserve, D.B.S.R., 1994). The liquidity of an asset depends on the convertibility and the speed of conversion to cash with no or little loss (Nader, 2002). Thus, liquidity risk is the uncertainty surrounding the speed and the availability of convertibility given the presence of a readily market in which there is active trading in the asset. It comes mainly from the inability of firms to raise funds to meet financing needs or the incapability to execute transactions at prevailing market prices due to lack of appetite of other market parties.

Banking institutions are vulnerable to liquidity risks as their fundamental role includes the transformation of short-term deposits into long-term loans. Consequently, they should focus on managing their liquidity to enable meeting obligations as they come due, without incurring unacceptable losses (BIS, 2008). Therefore, managing liquidity in terms of maturity and timing for assets and liabilities is considered a crucial part of financial management process which is widely known as working capital management. The ALM is a process that focuses on matching the supply and demand of funds through simultaneous forecasting of its dynamics in a manner that maintains liquidity risk within the set limits (Nader, 2002).

Many studies have defined liquidity risk as the ability of the financial institutions to meet and settle its obligations as they come due (BIS, 2008; Federal Reserve, D.B.S.R., 1994; Chorafas, 2007; Drehmann, 2013; Choudhry, 2011; Vento & La Ganga, 2009) The ability of the bank to meet its obligations depend on the condition of the macroeconomic environment, sector and entity specifics (Choudhry, 2011). Further, liquidity risks stems from various resources that is related to day-to day operations with regards to lending and trading activities (Chorafas, 2007). Therefore, the inability of these institutions to meet their obligations will

render the bank in default (Drehmann, 2013). Accordingly, ensuring the availability of funding to meet the expected and unexpected future obligations without affecting daily operations or the financial position of the institution, which is known as liquidity risk funding, over a specific horizon with reasonable costs (BIS, 2008; Drehmann, 2013; Vento & La Ganga, 2009).

The availability of various tools and techniques for managing liquidity has been widely identified, though many banks still have difficulties in managing their liquidity in a prudent manner. The global financial crisis illustrated the importance of proper functioning of the banking sector and how liquidity conditions can quickly change which highlights the importance of the central banks in safeguarding the proper functioning of the banking sector as a whole, and in some cases financial institutions. In response to these difficulties, Basel Committee have identified some basic principles in liquidity risk management for which banks should adhere to in order to ensure the soundness of the banking sector. It includes detailed guidance on risk management and supervision of funding liquidity risk (BIS, 2008; Basel Committee on Banking Supervision, 2010).

2.7.1 Liquidity management under Basel Committee

The Basel committee has identified sources for liquidity risk as Basel II considers the supervision of ALM under Pillar II (BIS, 2004). Thus, banking institutions monitor the changes in their liquidity positions through three main approaches, liquid assets positions, cash flows, and a combination of these two approaches. Further, several solutions to manage liquidity have been identified by the Basel committee. The adoption of the centralized or the decentralized approach depends on the structure of the institutions as financial institutions, flow of liquidity between parts of the institutions and the adopted policies and procedures (Chorafas, 2007).

Though liquidity management existed in the banking industry before Basel II for internal purposes, it is considered a new aspect of regulatory measures. The difference between Basel II and III with respect to liquidity management is that Basel II underestimated the importance of liquidity management, while Basel III introduced new management standards to strengthen the internal and regulatory supervision over liquidity management in the banking industry (Kubat, 2014). In 2013 Basel Committee[11], introduced the Liquidity Coverage Ratio (LCR) (BIS, 2013). The LCR objective to promote the short-term resilience of the liquidity risk profile of banks, and seeking to ensuring a bank has an appropriate stock of unencumbered HQLA consisting of assets that could be converted into cash with little or no loss of value in markets to fulfil its liquidity needs in a liquidity stress scenario for 30-calendar day (BIS, 2013):

$$LCR = \frac{HQLA}{Total\ net\ cash\ outflows} \tag{1.1}$$

The HQLA consists of two levels of assets, level (1), which include coins and banknotes, central bank reserves, and marketable securities guaranteed by sovereigns, central banks, IMF. On the other hand, level (2) assets include for example, corporate debt securities, marketable securities representing claims, residential mortgage backed securities, common equities shares that meet certain conditions, and level 2 assets after applied the haircuts not more than 40 percent of the total stock of HQLA (BIS, 2013). While, the denominator is Total net cash

[11] The Basel Committee is the global primary committee that establish international standards for prudential regulation in the banking sector and aim`s is to improving the regulation, oversight and procedures of banks around the world with a view to enhance economic stability and providing a type of collaboration on banking supervisory issues (BIS, 2015).

outflows over the next 30-calendar day, the interest that expected to received or paid within 30 day should be include in the cash flows in or out (BIS, 2013).

The Net Stable Funding Ratio (NSFR) is another key reform in Basel's Committee and requires banks to keep the appropriate funding profile with their asset structure and off-balance sheet activities (BIS, 2014). Maintaining a suitable funding profile mitigate the likelihood of disruptions to regular funding resources, the NSFR fosters the funding stability, and boosts in provide a clear assessing funding risk across all the balance sheet in/off items, through their limits to the over reliance on short-term wholesale funding. (BIS, 2014) :

$$NSFR = \frac{Available\ amount\ of\ stable\ funding}{Required\ amount\ of\ stable\ funding} \geq 100\% \qquad (1.2)$$

The available amount of stable funding is a portion of the capital and liabilities expected to be acquired during the period of consider the NSFR up to one year such as total amount of regulatory capital, the total amount of secured and unsecured borrowings and liabilities (BIS, 2014). While , the required stable funding which is residual maturities of the various asset that held in banks as well as banks off balance sheet exposures, such as coins and banknotes immediately, all central bank reserves, all claims on central banks with residual maturities of less than six months. NSFR should be equal to at least 100 percent (BIS, 2014).

2.7.2 Principles for liquidity risk management and supervision

Streamlining liquidity management supervision was one of the aims of the Basel committee for the banking institutions. They emphasized the existence of a robust liquidity management framework, which sets risks exposures that are consistent with the bank business strategy and funding their needs. The framework should take into consideration the business model of the bank as well as the currency exposures (BIS, 2008).

Furthermore, the framework should focus on funding diversification as well as managing liquidity for daily operations to meet their obligations on a timely basis, Moreover, differentiating between unencumbered and encumbered assets would increase the banks efficiency in managing their mismatches as well as their collateral positions. (BIS, 2008).

In addition, having a Contingency Funding Plan (CFP)[12] is a crucial part to safeguard banks from emergency liquidity shortfalls through using different potential sources of liquidity and remaining within the set exposure limits. The bank strategy should have a buffer of high quality liquid assets, which would ease the stress of liquidity shortfalls (BIS, 2008). Finally, a comprehensive assessment for the bank's liquidity management framework is important to ensure the viability of the bank and its resilience while facilitating cooperation with the supervisory authorities through transparency and the disclosure of financial information on a regular basis (BIS, 2008).

[12] CFP is a plan that sets out strategies for the management of various stress environments, lays down a clear lines responsibilities, is frequently tested to ensure the operationally strength for the plan (BIS, 2008).

Chapter Three: Asset and Liability Management

3.1 Introduction

Managing risks in a highly uncertain environment is considered a challenge for banks in the MENA region. The process of asset liability management is usually built on mitigating the impact of various risk on banks' performance through aligning the bank performance with the risks stemming from internal factors as well as its environment with the adopted business model while identifying measures to mitigate the impact of these risks is still open to debate (Zenios & Ziemba, 2006). During the 1970s, asset liability management became one of the main practices used by financial institutions to mitigate against the impact of volatile interest rates, which increased mismatches between assets and liabilities , ALM is intertwined with strategic planning as it offer solutions for mitigating against risks arising from bank operations while focusing on maximising profits. Therefore, the decision-making process in financial institutions is more complex in nature than in other organisations as banks tend to support different lines of services (Choudhry, 2011).

In Jordan, banks strive in managing their portfolios in a highly volatile region, especially since the break out of the Arab spring. Banks efforts crystalized through preserving their viability and continuing to have a solid performance through registering net profits (CBJ, 2017). However, little studies, according to the best of my knowledge have focused on the Asset Liability management at Jordanian banks though it presents itself as a unique case worthy of studying due to the geopolitical unrest in the region and its impact on banks' balance sheet as well as the domestic economic environment. Therefore, in this chapter the researcher will try to identify the main elements of the ALM process, the ALCO committee main functions and the tools and metrics used to set and mitigate risk exposures through using a survey that distributed to all commercial banks in Jordan.

3.2 Literature Review

In this section, the researcher will discuss the existing literature on asset and liability management (ALM), asset and liability committee (ALCO) frameworks, and the mechanisms that these managements and committees use in Jordanian commercial banks. ALM has gained increased attention in recent decades due to the crucial role of banks in the stability of the global financial system. This requires banks to have reliable frameworks that can help them to mitigate against risks stemming from market fluctuations. Such market forces, according to Pragathi and Veena (2018), are highly unpredictable because of the macro effect of factors in both the domestic and global markets. Furthermore, the optimal structure of the balance sheet needs to be ascertained in strategic planning to maximising profits while also minimizing risk through greater efficiency in managing assets and liabilities. According to Chakroun and Abid (2013), in making such decisions, banks should analyse present and future conceivable economic circumstances while also addressing the many impositions of restriction on its environment. The concept of ALM was settled as strategy for a hedging reaction against the risk of financial institutions. In relation, Zawalinska (1999) stated that the evolution of ALM and how organisations developed depend on their experience in risk management. Therefore, the ALM process can be described as a dynamic process of planning and coordinating to achieve a bank or organisation's desired goals.

ALM has changed significantly over the past two decades with the growth and integration of financial institutions, and the emergence of new financial products and services (Tektas, 2005). In addition, new financial activities have increased the types of risk in the market today, which necessitates the use of qualitative skills to manage risks and improve the performance of financial institutions. As such, ALM is associated with the optimal investment of assets for achieving current goals and dealing with upcoming liabilities. ALM entails the joint assessment

and evaluations of risks as well as benefits for assets and liabilities. In this regard, the purported silo approach[13], which is the more conventional method for discrete management of risks, is no longer suitable for financial institutions (Romanyuk, 2010). At the beginning, management was based on a simple gap that concerned analysing cash-flow risks and mismatches between assets and the other side of the budget. As banks' risk management practices have developed, cash-flow gap models progressively moved to duration gap models, which are more concerned about the market value of financial institutions' rate-sensitive assets and rate-sensitive liabilities (i.e. sensitive to changes in interest rates) rather than just the difference between them (Shrestha, 2015).

ALM considers the decisions and actions taken with respect to both sides of the balance sheet to ensure that banks' resources are effectively utilised to maximise profitability and mitigate against risks. In addition, macroeconomic variables have an impact on banks' ability to generate profit. Shrestha (2015) reports that the fast development of the financial markets, and the vast movement of trading within capital markets, as well as the recent advent of risk-analysis technology, necessitates the implementation of ALM. Consequently, the ALM strategy revolves around how banks arrange and match the main two sides of their balance sheets. Here, the first side concerns the uses of funds and the other concerns the sources of these funds, against various risks such as liquidity risk, interest rate risk, exchange rate risk, and credit risks. In other words, asset liability management (ALM) is necessary to manage both balance sheet sides simultaneously to mitigate against fundamental[14] and other types of risk and to maximise operational income. Therefore, ALM is a continuous and comprehensive

13 Managing risks separately depending on the risk type (Romanyuk, 2010).
14 This refers to factors far beyond an institution's control such as political, economic, and social developments (Bessis, 2015).

strategy based on assessment and managing banking institutions effectively to achieve set goals while reducing banks' exposure to various risks, thus ensuring efficient usage of banks' available resources. Further, should also draw the guidelines for the optimal investment strategies that achieve the institution's targets and safeguard investors' equity (Choudhry, 2011; Novickytėa & Petraitytėa, 2014).

3.2.1 Theoretical Literature Review

The nature of operations within financial institutions and the risks that face them are reflected in their balance sheets. More specifically, the asset side of a bank's balance sheet expresses the risk of the surrounding environment, while most risks stemming from business operations are reflected in the liability side. Aligning these risks is the main purpose of ALM as it provides quantifiable measures of risk and strategies for managing them. Early studies have focused on various terms and scenarios under which funds are allocated; some considered liquidity and regulatory constraints, such as the capital adequacy ratio, (Chambers & Charnes, 1961; Cohen & Hammer, 1967) and changing financial structures accordingly. Others stressed the importance of liquidity classification, and the rates of the return and maturity (Bradley & Crane, 1972). These studies were based on Redington (1952), Markowitz (1952) and Myers (1968), who instigated the conceptual framework of ALM which latter studies used to build operating models for ALM. These studies focused on structuring assets and liabilities to make optimal trade-offs between liquidity, return, and risks (Kusy, 1986). Many important factors should be taken into consideration such as performance metrics and stakeholders' views; for example, capital allocation strategies should reflect shareholders' choices regarding different financial risks (Adam, 2008).

These models provided more complex tools for organisations to manage their balance sheets more effectively and encouraged them to consider more diverse strategies to manage risks.

Redington (1952) focused on the concept of "matching" investments in terms of interest rate, immunization, and duration in the context of a firm's net worth. Redington (1952) presumed a flat yield curve – that is, a single interest rate for all discounting of cash flows. Boyle (1978) and Shiu (1986) have pointed out the main defect of this approach as assuming a flat yield curve paves the way for the existence of arbitrage opportunities and fails to provide protection against general yield curve shifts.

Redington's model has been extended by Fischer and Weil (1971), who introduced a non-flat term structure and yield shifts. They developed the immunization strategy based on duration. Hiller & Schaack (1990) presented a classification of bond-portfolio in terms of asset liability and hedging methodology (dedication[15] and duration matching). They modified the definition of duration to accommodate the increased complexity in asset liability components. Later developments of the Redington theory focused on new definitions and measures of immunization and duration corresponding to yield curve shifts.

The incorporation of the concepts of immunization, which began as a short-term ALM model, and dedication within ALM gained the attention of financial modellers as a way to design robust portfolios. The main goal of decision makers is to enhance asset returns while managing liabilities to ensure that institutions can meet their financial obligations as they fall due. Thus, ALM provides decision makers with a wide variety of strategies and risks that should be considered on both the asset and liability sides of the balance sheet (Choudhry, 2011). Some ALM strategies focus on liability management, which is considered more conservative, by fully matching assets and liabilities. Others focus on matching changes in assets and liabilities

[15] Also known as cash matching, which is a passive management system that preserves some assets in order to serve future liabilities when they fall due. Further, it is considered as a long-term oriented ALM model.

according to interest rate sensitivities (immunized portfolios) through focusing on net present value and average duration of life. The main aim of immunization is to maintain the dominance of assets over liabilities at a minimum cost, which requires matching present values, interest rate sensitivities and changes in the portfolio over time.

The efficient portfolio concept introduced by Markowitz in 1952 summarized the trade-off facing each investor, maximising return and minimizing costs. Investment decisions not only focus on decisions to invest in certain securities but also on how to divide capital among amongst different securities. The theory of portfolio selection identifies all feasible portfolios that minimize risk for a given level of expected return depending on one period mean-variance model (Kaplan, 1998). In addition, it assumes normal distribution of returns and the employment of a risk aversion utility function. Further, it assumes that the value of an asset depends on the expectation and variance of its return and the covariance with the return of all other existing and potential investments (Kusy, 1986). Moreover, Markowitz defined a "good portfolio" as a tool that provides protection from a wide range of contingencies with respect to the investor's risk-averse utility function. In addition, Markowitz specified salient features that affect investment returns such as political and macroeconomic factors, and the correlation between securities' returns (Markowitz, 1968). However, the efficiency of the model depends mainly on its ability to produce reliable forecasts.

Others have argued that portfolio selection models are inappropriate for making investment decisions due to the presumed risk-interdependence between securities. Myers (1968) attempted to identify the most appropriate objective criterion for investment appraisal and illustrated the need for risk-independence for securities to achieve market equilibrium, which implies risk dependence between securities and investment opportunities to maximise net

present value. Thus, diversification is not the appropriate objective for firms trying to maximise shareholder wealth.

Pyle (1971) constructed the first static model based on Markowitz's theory to deal with the portfolio risk problem where banks select the level of assets and liabilities throughout the model period. It was also based on the hedging theory of Tesler (1955), which investigates risk aversion and resorts to safety under uncertainty, but it neglected some important elements in banking operations such as liquidity transactions, matching assets and liabilities, and transaction costs (Telser, 1955). In addition, the model ignored other types of risks that induce uncertainty and only focused on portfolio risk. Later extensions have considered liabilities within asset mixes for the remainder of a portfolio (Sharpe & Tint, 1990).

Most of these theories agree on the need to mitigate risk to maximise profits for financial institutions. However, their views of performance metrics are different as the identification of these measures relies on stakeholders' views of capital allocation and the way managers perceive risks. The Redington theory focused on pension fund risk by immunizing fund valuations against interest rates by matching asset cash flows with projected liability flows. Furthermore, Markowitz's theory focused on the portfolio risk of stock investment and highlighted the importance of diversification due to the correlation of returns among assets.

Many approaches for managing assets and liabilities in financial institutions, and the banking sector in particular, have been discussed theoretically, which illustrates the strong need to mitigate against various risks in the banking industry and for regulators. Thus, managing risks stemming from banks' operations and the surrounding environment is considered a continuous and dynamic process that requires specific strategies.

3.2.1.1 The Emergence and Importance of ALM

Decision-making processes in financial institutions are more complex than most organisations as banks tend to support different lines of services. Thus, the main purpose of creating a general framework for financial institutions is to chart management decisions towards achieving set goals. Asset liability management (ALM) emerged in response to the need to manage both assets and liabilities simultaneously in order to mitigate against various risks as well as fundamental risks and maximise operating income. Furthermore, setting the overall strategy for commercial banks to manage effectively asset-liability components requires a focus on a number of key pillars. The first pillar is concerned with managing banks' liquidity position in terms of liquid assets and maturity profiles, while taking into account the market conditions. The second pillar focuses on risks stemming from day-to-day operations such as default risk (Choudhry, 2011).

Therefore, ALM is a vital issue for banks' strategic planning, assessment and management of endogenous financial operations and external risks (Tektas, et al., 2005). In addition, ALM should be considered a dynamic process of planning, coordinating, and controlling assets and liabilities in term of their volume, maturities, yield, and costs in order to achieve a specified net interest income (Charumathi, 2008). Management must also mitigate against various types of risks stemming from banking operations. Thus, ALM should focus on potentially matching assets and liabilities in terms of their maturity and the interest rate sensitivity to minimise interest rate and liquidity risks and maximise shareholder value (Zawalinska, 1999).

Consequently, ALM is a continuous and comprehensive strategy based on effective assessment and management of banking institutions to achieve set goals while mitigating against exposure to operational and market risks such as liquidity risk, interest rate risk, exchange rate risk, and credit risks. ALM thus ensures efficient usage of banks' available resources. Furthermore,

ALM should also draw guidelines for optimal investment strategies to achieve an institution's targets and safeguard investors' equity (Bessis, 2015).

ALM has become an essential tool within the banking sector to address the multitude risks and challenges that banks may be faced with at present and in the near future. The implementation of ALM protects banks to a certain level, while also preparing the management of banks for such risks. The use of this approach can assist management in recognising banks' existing market risk profiles and future risk profiles.

Management can also assess the effect of alternative decisions for the aforementioned risk profiles. In addition, the assessment of these risk profiles assists bank management in determining the appropriate course of action based on their bank's capacity to take risks (Meena, & Dhar, 2014). The entry of foreign players into the domestic banking market in recent years has led to changes within the financial markets and led to increasing rivalry between institutions. The markets have now have become more intricate, therefore necessitating strategic management tools (De, 2003).

ALM is hence a broad term that describes several matters by differing market players. The main purpose of ALM is to manage interest-rate risk and liquidity risk. Aside from that, ALM also forms a general policy for credit risk and credit risk management, notwithstanding the tactical-level credit policy being fixed at a lower level among credit bodies. In relation to this, Novickytėa and Petraitytėa (2014) reported that the most common problem emerges when a bank's liability costs increase at a faster rate than the revenues from their assets, or when falling interest rates mean that asset income drops at a faster rate liability costs. Notably, ALM's fundamental principles appear to be more apt for commercial banking as opposed to investment banking. Nonetheless, ALM should be implemented within both types of banking. ALM connects different banking activities into one unit to ease management of liquidity and the

balance sheet. This is important so that a bank's normal operations, service delivery, and consistent and profitable progress can be assured. The use of ALM allows a bank to identify possible problems and operating risks within its balance sheet and income statement (Novickytėa & Petraitytėa, 2014).

Volatile interest rates and liquidity risks have compelled banks to shape their portfolio of assets and liabilities in a manner that minimises the risk in the portfolio. However, it is important that bank management sustain a sound balance between the gap, profitability and stability. In this regard, bank management must manage market liquidity risk and interest rate risk, which is why a framework is needed. According to Bessis (2015) and Choudhry (2018), the application of this framework allows management to tackle these risks and bank performance could be optimised.

The use of ALM in banking systems involves bank operations in both sides of balance sheet. Brick (2014, p.12) ALM as a *"forward-looking process involving the joint and simultaneous management of assets and liabilities to measure, monitor, and control the effects of changing interest rates on income, asset values, liquidity, and regulatory capital".*

According to Shrestha (2015), the fast evolution of ALM has been driven by the following factors: recent advancements in the capital markets, theoretical and technological innovation in risk analysis, and financial intermediaries' awareness of the need to adopt ALM. The conventional perception of banks' activities is that a bank takes deposits with short-term maturities from a vast amount of people and give loans with long-term maturities to a small amount of borrowers. Therefore, these activities of transformation expose a bank to risks associated with credit, interest and liquidity. Therefore, banks need to make strategies or frameworks to manage, measure and control the risks associated with assets and liabilities to ensure the validity and stability of their activities. Strategies and frameworks will provide

information to management on the general overall position of a company, and from the incorporation of ALM, banks will achieve their sought-after efficiencies and performance (Romanyuk, 2010; Choudhry, 2011; Bessis, 2015).

3.2.2 Empirical Literature Review

The following section will discuss the existing empirical literature that has investigated the ALM in the banking sector. The surveyed empirical literature can be segmented into two main streams: one that focuses on the MENA countries, and the other that examines banks worldwide. The main findings of these studies were that the ALM is a crucial element that can be used in risk management to mitigate, control, and monitor various types of risks stemming from banking operations and external environmental factors. However, the literature on ALM for Jordanian banks is relatively scarce, and to the best of the researcher's knowledge, this study is the first to describe the ALM frameworks and the ALCO in Jordanian banks. In the next section, the study will discuss the ALM process and asset liability committees in banks.

3.2.2.1 ALM Process and ALCO

Balancing risks and profitability in the banking industry has been the main part of the decision-making process. The inability to control surrounding environmental factors and their impact on business lines has compelled banking institutions to set up strategies and policies to mitigate the impact of these shocks and benefit from existing opportunities. Thus, the main role of ALM is to provide metrics for various types of risk exposure while maximising banks' risk return profile such as net interest income and economic value (Choudhry, 2011). The majority of banks have established a committee known as an Asset-Liability Committee (ALCO)[16] to

[16] It is also known by other acronyms; for example, Balance Sheet Risk and Management Committee (BRMC) or Asset-Liability Policy Committee (ALPC), but the most used term is ALCO.

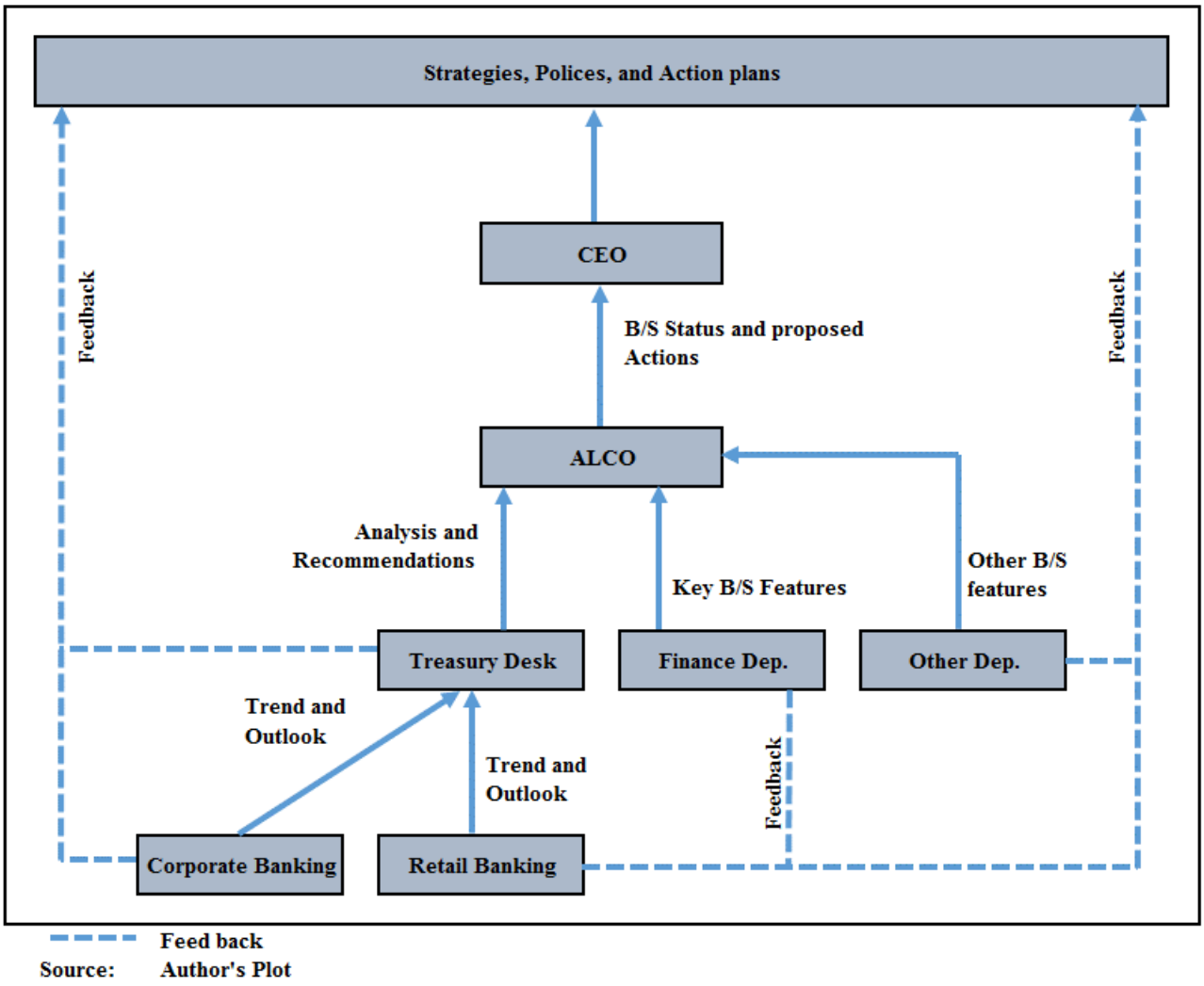
effectively mitigate against various types of risks. Its main role is setting policies and building strategies on a balance sheet level based on detailed analysis of risk-return trade-off, and implementing the set goals for the different performance metrics that it monitors (Buehler, 2008). ALCO is considered the implementation arm of ALM (Choudhry, 2018). The members of ALCO should include senior line managers and represent all of a bank's business activities and processes (Greuning & Bratanovic, 2009). The committee members must meet on a regular basis to discuss recent developments in the various business lines represented and any changes in the surrounding environment (Choudhry, 2012). The frequency of ALCO meetings is important to achieve the committee's goals and proposed strategy. The frequency of these meetings in banks is often influenced by the stability of those banks' balance sheet and the complexity of their activities and products. If the market is more volatile and the banks' activities more exposed to risks, meetings should take place at least once or twice a week (Dedu & Vasilache, 2008).

ALCO meetings generate action plans, business policies and banking portfolio management solutions based on management reporting analysis focused on the banks' lending margin, interest income, variance from last projection, customer business, and future business, by assessing projected returns, revenue and risk exposure. Further, meetings should consider acceptable levels of risk exposure, the existing risk limits, and hedging policies (Choudhry, 2012).

The ALM process is undertaken by the financial department, which is responsible for interest rate risk, funding risk, internal transfer of funds, allocation of risks across business units, management control and reporting, or by a separate unit in the treasury department depending on the size of the bank, the variety of products and services it offers, and its organisational structure. One of the main responsibilities of the treasury department or separate desk is to

report to the ALCO; this report usually includes financial and business lines and risk management (Bessis, 2015).

Figure 11: ALM Process



As such, consistent evaluation and control are needed in ALM strategies and this is only attainable via reports and research, which allow the bodies operating in the banking sector and others to tackle such challenges, whether current or forthcoming (Suresh & Krishnan, 2018). The ALCO is dependent on reports from various units in the bank. Further, many ALM desks formulate their hedging strategy within the overall context of funding and liquidity policy.

Their hedging requirements are usually met through using plain vanilla products.[17] Here, the ALCO takes into account the bank's risk aversion level and need to manage its risk exposure, future expectations of interest rates, revenue level and profit maximisation, market volatility, and the overall cost of hedging (Choudhry, 2012). Figure12 (above) illustrates the asset and liability management process in banks.

The ALM process could be viewed as top-down, and it starts with setting up policies and guidelines for the operating limits of risk-return trade-offs and communicating its recommendations to the bank's board of directors. As a dynamic process, a periodic review of the bank's current position and forecasts for its positions according to different scenarios are made in order to establish strategies and take any decisions that need to be made about the bank's risk exposures. Decision-making is considered one of the main responsibilities of the ALCO committee (Choudhry, 2012).

3.2.2.2 Reporting to ALCO

Decisions are communicated to execution bodies and different units in the bank about its risk exposures and position. In addition, the ALCO receive reports from the various departments and units that represent the banks activities and business lines. Finally, the evaluation process of the selected strategies is undertaken through comparing the set guidelines with the actual achievements (Bessis, 2015; Choudhry, 2012; Faruk & Alam, 2014). The overall ALM report, which shows the components of the bank's ALM and takes into account macroeconomic factors such as changes in the yield curve, may also include global balance sheet management. In addition, business line level reports are looked into; they focus on the return on capital generated by specific business lines.

[17] Standard type of option or financial instrument such as option bonds, futures, and swaps.

Furthermore, other reports contain an analysis of the gap and credit exposures. All of these reports must include interest income variations that are caused by market fluctuations and separate returns and risks according to product, business line, sector, and country. In addition, the reports should contain scenario planning under micro and macro level market conditions and the latest short-term projections (Choudhry, 2012). Thus, to obtain an insight into what a bank is trying to achieve with its ALM framework, it is important to evaluate the primary functions of its ALCO. Furthermore, the construction of policy statements and annual reviews should also take into account the changes that occur in the balance sheet and market dynamics (Faruk & Alam, 2014; Canada, 2004). Banks need to establish an ALM policy statement which entails specific descriptions of how bank management would manage their asset/liability position and clearly determine the authority and accountability for such asset/liability management.

In addition, the role of the ALCO in the bank must be clearly defined, because it provides a framework containing its activities that are to be performed (Gabriel , 2016). Effective ALM can provide a correct balance in the risk and return management process (Choudhry, 2012). Further, it is important to have a suitable blend between skills and risk appetite. In addition, the operating forecasts and suitable metrics need to be set. When needs are aligned with market realities, a bank is operating within its preferred risk appetite (ADB, 2009).

One of the core tasks of ALCO is to manage liquidity risk, which arises from volume and maturity mismatches of assets and liabilities. It requires an understanding of a bank's day-to-day liquidity needs, matching, interest rate sensitivity, and the effect of the interdependency of re-pricing and credit risk on liquidity (Bessis, 2015). The ALCO's responsibility is to monitor the development of its bank's balance sheet and capital requirements and set targets and limits

for risks. In addition, it reviews the bank's liquidity risk management and funding structure and monitors performance against the approved risk appetite (NIB, 2015).

The ALM process encompasses the identification of policy and liquidity, contingency solution plans and liquid asset holdings in order that the liquidity risk is within the preferred level (Novickytėa & Petraitytėa, 2014). Furthermore, ALCO must realize the effects of various factors on liquidity and cash flows such as the interest rate, credit, and capital risk. Thus, the inter-relations between these factors and liquidity are essential to identify in order to preserve the solvency of the bank and its ability to meet its financial obligations (Vij, 2005). One of ALCO's core tasks is to regularly monitor actual cash flows against projections. This is to determine that changes in loans and deposits are transitory (Choudhry, 2018). In addition, the committee are responsible for recognising the permanent changes that could affect balance sheet positions and take proper actions if necessary.

Moreover, ALCO focuses on managing the maturities of banks' assets with the objective of covering cash flows from matured assets to meet liquidity needs. Thus, determining the size and duration of liquidity buffers is considered a crucial part in managing liquidity as shortages may trigger massive withdrawals from depositors and an increase in the bank accessing credit facilities, making the bank more vulnerable to insolvency while also increasing the cost of raising money (Koch, et al., 1999).

The differences between assets and liabilities take three basic shapes: cash matching, overfunding, and underfunding. The simplest approach to ALM is to match a bank's assets to its liabilities. Somehow, this appears to be increasingly impractical due to the increased complexity in the financial system. In addition, with time, banks have progressed from the application of a single gap analysis to more sophisticated techniques. Nevertheless, analysing

the marginal gap[18] and liquidity gap time profile between assets and liabilities with a future expectation of the gap position is still a crucial part of the ALM process (Bessis, 2015).

The progression of strategies and methodologies is factored by diverse philosophies regarding the role that ALM and banks play in markets (ADB, 2009). In general, bank asset and liability management or treasury functions in developing markets are usually simplistic. In addition, a support function concentrates primarily on liquidity management. Hence, it is not unusual for these banks to not partake in more sophisticated capital markets transactions (e.g., derivatives) due to the dearth of knowledge regarding the instruments. Therefore, ALM or treasury functions within the context of developing markets have started to adopt more structure, more activities and a larger directive.

Simply put, asset and liability management can take on full balance sheet management obligations, engaging in analytics and multifarious hedging activities. In general, this is called the 'integrated treasury function',[19] whereby the main purpose is making profit while managing hedging; the construction of the structure of banks' governance to provide comprehensive information to the board of the bank regarding the risks being run is mandatory and crucial (ADB, 2009).

As for the overfunding and underfunding situations, generating mismatches causes liquidity and interest rate risk depending on the interest rate spreads between assets, liabilities, and their time profile. Targeting a funding profile depends on the decisions of the higher management and the ALCO committee about closing the gap or creating and maintaining mismatches (Bessis, 2015). Under cash matching, it is implicitly assumed that the amortization and

18 Known also as the incremental gap, it represents the liquidity gap differences in variations between two adjacent time points (Bessis, 2015).

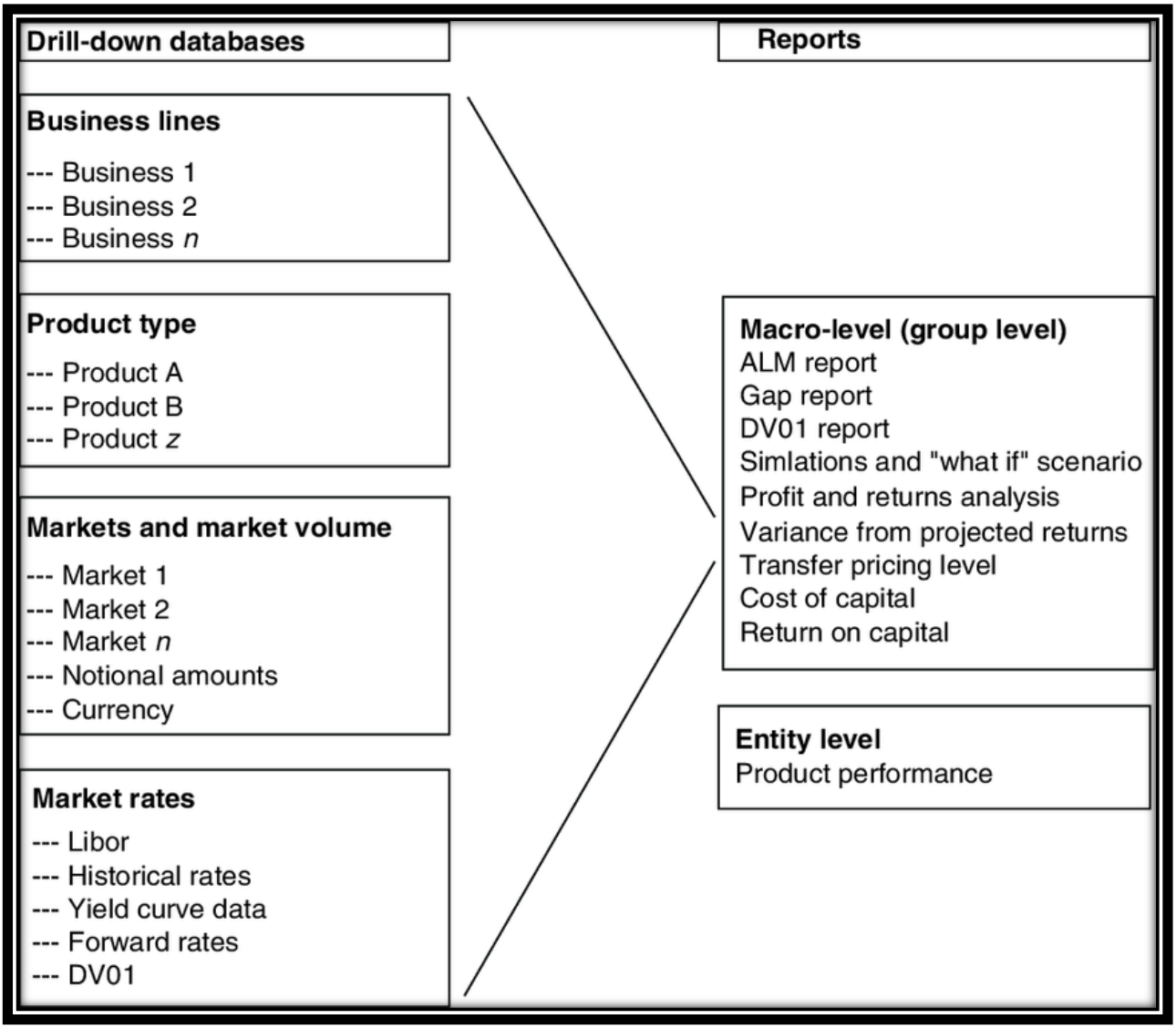
19 Used in developing markets when the treasury function has more activities and a broader mandate (ADB, 2009).

repayment schedules of assets and liabilities are identical. Two aspects should be considered: managing their liquidity under normal business settings, and under stress circumstances (Choudhry, 2011).

Every bank needs to establish a framework and plan of implementation for both sides; this framework will take into account the specifics of the business activities that the bank is partaking. Moreover, the risks associated with the numerous businesses are analysed and ranked, followed by the decision on the amount of risk that should be taken by the bank and the tools involved. Several tools of liquidity measurement that are employed in the banking industry are concentration ratios, dynamic cash flow gap, static funding gap, and liquidity stress measurement and liquidity asset ratios (Choudhry, 2018; Bessis, 2015). The Asian Infrastructure Investment Bank (2017, p. 5) notes that the "*ALM policy requires an effective system of internal control for market and liquidity risk. Such controls shall ensure the following: Implementation of: (a) appropriate limits and enforcement on risk taking; (b) adequate systems and standards for identifying, measuring, monitoring and evaluating risk; (c) standards for valuing positions and measuring performance; (d) a comprehensive ALM risk reporting and ALM review process; and (e) effective internal controls. Clear lines of authority and responsibility for the management and control of ALM risk*".

As a concluding remark to this subject, asset and liability management is consistently evolving. Consequently, the ability of an ALCO to monitor and measure risks in the market determines the viability of a bank. Thus, they need detailed reports that reflect the bank activities and the market conditions. Therefore, each bank must have an appropriate ALCO committee to scrutinise risk and monitor its growth and stability (Joshi & Sontakay, 2017). Figure 13 illustrates such general reporting input and output.

Figure 12: ALCO input and output reports



Source: An Introduction to Banking: Liquidity risk and asset-liability management (Choudhry, 2011).

The main report is the overall full balance sheet management reports. The other reports include specific business lines and products and reports showing the aggregate revenues and risks in every business line. Other reports consider market risk exposure and credit risk and are used to plan for various market conditions (Choudhry, 2011).

3.2.2.3 Asset Liability Management in Global Context

ALM emerged as banks needed to manage both their assets and liabilities simultaneously in order to mitigate various risks and maximise their operating income (Chorafas, 2007). Banking

risk management in general and asset and liability management in particular have received attention worldwide (DeYoung & Yom, 2008; Zawalinska, 1999; Kosmidou, et al., 2004; Tektas, 2005; Dash & Pathak , 2011; Shrestha, 2015; Tee, 2017; Chatterjee & Dutta, 2016; Meena, & Dhar, 2014; Suresh & Krishnan, 2018), specifically in the MENA area in the wake of the Arab Spring (AL-Mutairi & Naser, 2015; Mokni, et al., 2015; Abu Hussain & Al-Ajmi, 2012; Selma , et al., 2013).

Consequently, ALM is a way to mitigate against various possible risks and maximise operational income for banks. In the US, DeYoung and Yom (2008) employed the canonical correlation for a sample of US commercial banks for the 1990-2005 period. The results showed that the linkages between assets and liabilities are dictated by bank size as well as the application of tools for mitigating risk including interest rate swaps and/or adjustable rate loans. They found that the associations between assets and liabilities appear to be stronger in smaller banks and weaker in larger ones.

In addition, there appear to be systematic intuitive interactions between individual asset and liability accounts – notably a strong positive connection between long-term loans and core deposit funding, and between short-term loans and purchased funds financing (DeYoung & Yom, 2008).

Kosmidou and Zopounidis (2004) employed the goal-programming model together with simulation analysis to study ALM in a Greek bank over a one-year period. They reported that for the bank under study, the optimal strategy was not the same as the actual strategy. For this reason, they suggested that the bank re-evaluate its present policies. In their study, the two primary goals of the program were solvency and liquidity, and they employed both solvency and liquidity as proxies for risk measurement. In particular, solvency was measured using capital to total weighted assets while the current ratio was employed as a measurement for

liquidity risk. While goal programming models and simulation analysis are integral tools in the construction of ALM strategies for optimal asset-liability positions, they also function as complements for the maximisation of liquidity and the mitigation of possible risks.

In a study by Tektas et al. (2005) in Turkey, a goal-programming model was employed on two medium-scale commercial banks that engage in distinctive risk-taking behaviour. In this study, the authors tried to explain the impacts of different strategies employed by management when handling a crisis. In this regard, they were specifically concentrating on the banks' programme goals, liquidity, capital adequacy ratio, deposit and loan market share, and revenues. Accordingly, optimistic and pessimistic scenarios were run in this study.

In the optimistic scenario, the two banks are assumed to accomplish the prescribed goals in the programme. On the other hand, the study found that in the pessimistic scenario, the banks are expected to adjust their balance sheet accordingly. This study indicated that worsening conditions in the market cause interest rates and expenditure to change, and such changes impact bank's revenue targets. Tektas et al. (2005) also mentioned that banks' liquidity goals are also impacted because in this situation they will lose the ability to sell their government securities as economic agents would choose to retain higher liquidity.

The impact of ALM on profitability and bank performance has been scrutinised by several researchers (Kosmidou, et al., 2004; Tee, 2017; Chatterjee & Dutta, 2016; Shrestha, 2015; Sayeed, 2010). Kosmidou et al. (2004) looked at 36 domestic banks and 44 foreign banks in the UK and found disparity between banks' returns and linked it to the difference in the composition of asset-liability between foreign and domestic banks. Furthermore, they suggested paying more attention to liability management as opposed to asset management. The authors suggested how and where management should allocate their time and attention to improve these banks' performance.

Dash and Pathak (2011) studied 57 public, private, and foreign banks in India in an attempt to determine optimal asset-liability positions and matches for profit maximisation within the constraints of liquidity and statutory requirements. The authors constructed a linear programming model to assess the impact of public ownership on ALM based on the outcomes. They reported that as opposed to private banks, the procedure of ALM used by Indian public banks appeared to be better and more diversified; this finding has been linked to the composition of the banks. In addition, banks should keep monitor their asset-liability positions carefully and balance their profitability, liquidity (Dash & Pathak , 2011). On the other hand, Zawalinska (1999) examined various approaches to ALM by commercial banks in Poland and highlighted the importance of privatizing public banks to improve their profitability, efficiency and risk management.

In Nepal, the impact of ALM on the profitability of seven leading commercial banks was examined by Shrestha (2015). These seven banks generated almost half (49%) of the total net profit of Nepal's entire commercial banking sector (30 banks) over seven years (2007-08 to 2013-14). ALM in this context is used to determine the optimal investment of assets to meet banks' present goals and future liabilities (Shrestha, 2015). In this study, Shrestha found a positive rate of return on assets with the rate differing based on the assets. He indicated that the cost rate on liabilities appears to be negative and the rate differs based on liabilities. Furthermore, the pooled OLS regression analysis results concluded that all assets including fixed assets and other assets have a positive effect on profitability.

Conversely, Shrestha reported that liabilities have an adverse impact on the profitability of commercial banks. He listed GDP and inflation rate as the macroeconomic variables that negatively impact the profitability of commercial banks. In addition, he outlined the presence of a link between ALM and bank profitability, and that ALM affects the financial performance

of Nepalese commercial banks. Based on these outcomes, Shrestha (2015) recommends that banks focus on increasing public awareness of the need to attain greater saving and fixed deposits, as this will consequently improve banks' performance in extending loans to customers. Therefore, in any market, macroeconomic environments and potential crises, which are considered one of the factors that impact profitability and ALM strategy planning, will depend on the cyclicality of economic conditions (Belete, 2013; Ali, et al., 2011; Shrestha, 2015; Tee, 2017). A number of studies have found that cyclicality in macroeconomic variables is one of the factors that affects volatility in ALM policies. Also, they found the ALM policy tends to resist the economic cycle, which may induce some attention in planning and forecasting different scenarios of their operational effectiveness as the higher risks involved might cause higher losses (Novickytė & Petraitytė, 2014).

Tee (2017) investigated the effect of ALM on the profitability of Ghana's listed banks. The author carried out multiple linear regressions with ROA as the dependent variable with total assets and total liabilities – which denote banks' blend of assets and liabilities – as the independent variables alongside interest rates and GDP as the economic factors. The study concluded that there is a positive relationship between total assets and bank profitability and a significant negative impact between total liabilities and bank profitability . The study also found that the interest rate, as one of the macroeconomic variables, imparted no significant impact on Ghanaian commercial banks' profitability (Tee, 2017).

Chatterjee and Dutta (2016) studied 26 public sector and 20 private sector banks in India over 2004–2005 to 2012–2013 and examined the relationship between profits and asset–liability composition. Using panel data regression and their other results, they concluded that the earning before tax generated by all assets in public banks, while the private banks the earning

from loans and advances and deposits placings to banks. They classified the banks into two groups – high profit banks and low profit banks – using the median value of earning before tax.

The low-profit banks had a greater return rate on loans and advances, investments and fixed assets and lower rates of return on deposits placings to banks as opposed to their high-profit counterparts. Moreover, the high-profit banks had the lowest cost rate on other funding whereas for the low-profit counterparts, 'short-term funding' appeared to be the cheapest funding source. As opposed to low-profit banks, the high-profit banks generally did not appear to have lower funding costs. In addition, non-performing assets had negative impact on profitability for both high-profit and low-profit, public and private banks (Chatterjee & Dutta, 2016).

In the context of ALM strategies and liquidity practices in Indian banks, Meena and Dhar (2014) analysed and compared the liquidity ratios and ALM practices of three leading banks from the public, private and foreign sector over 10 years. The liquidity ratios of the banks were analysed in order to find out the banks' short-term liquidity. In addition, the banks' ALM was examined by determining their liquidity position via their maturity profile (the year profile for 2011 was selected). Asset size was the criterion used in the study to choose the bank sample size. The results concluded that the general liquidity structures of banks in India is stable. However, the authors found that the amount of cash that these banks were keeping could cause issues in the long run as it was weakening their profits. They also noted that the State Bank of India is slightly different from the other nationalized banks in India. Furthermore, these leading banks have the capacity to impact the general structure of the maturity gap in their respective group. Nonetheless, the authors were also aware that ALM practices are entirely dictated by management. Indeed, banks have the prerogative to shape their own ALM structure in line with what they believe to be the most wide-ranging/comprehensive practice (Meena, & Dhar, 2014).

Nonetheless, banks generally follow a similar trend. Three categories of banks (public, private and foreign) were covered in this study; for each category, three leading banks were chosen. The banks became the benchmark for their corresponding sectors. For this reason, Meena and Dhar's (2014) study is of value to banks that wish to employ these practices to further their success. These banks can also be compared and suggestions can be made to match the best in the business. The researchers concluded that the short-term liquidity positions of banks in India is generally very good, and that all of them are financing their short-term liabilities using their long-term assets.

Suresh and Krishnan (2018) looked into asset and liability mismatches in banks in India (maturity gap). They selected two public and two private sector banks as their sample and used data from the financial years 2007-08 to 2016-17. This study particularly attempted to comprehend the patterns of short-term and long-term liquidity of these banks, in addition to the strategies employed to maintain liquidity risk. They opted to use gap analysis (Suresh & Krishnan, 2018).

This method was chosen due to the limitations faced by the study, including the non-accessibility of confidential data in the public domain (e.g., data for structural liquidity statements and data for short-term dynamic liquidity statements). From the analysis, the authors found that public sector banks barely demonstrated any common trends. Nevertheless, in many cases, they found that both banks had negative mismatches in the short term and in the medium term as well. Hence, the study warned that maintaining negative gaps in the short run might cause banks to lose their interest income because of the future increase in interest rates. On the other hand, in the long run, the banks showed a positive gap; this sign is rather positive because, according to the authors, a positive gap denotes a strong base of long-term deposits and advances. Many other methods could have been used (e.g., VaR simulation, ratio analysis,

stress testing, ratio analysis and scenario analysis) but these depend on data availability (Suresh & Krishnan, 2018).

Novickytėa and Petraitytėa (2014) studied the banking sector in Lithuania, particularly in terms of its ALM activity. Their study attempted to understand the degree of sustainability during different stages of the business cycle. In addition, they tried to identify how banks can handle their risk-based business cycles.

The study found that the banks were inclined to take more risk over time and they noted the difference between the cycles of bank assets and liabilities and those of business activity levels. As such, banks appear to be managing their assets and liabilities while also trying to improve their activity and profitability. Analysing changes in items on the balance sheets of both types of bank (commercial and foreign) found that the financial sector appeared to be more willing to take more risk in ALM when there was an economic upturn but this changes during economic shocks. In addition, there is a very close link between the assets and liabilities of both Lithuanian commercial and foreign bank branches and GDP, the volatility of ALM policy is triggered by the variations or expectations of variation in the cycle of the Lithuanian economy. The study reported the presence of moral hazard in Lithuania's financial sector; this is because the most risky balance sheet items change in a risk-free manner after the Bank of Lithuania deploys conservative measures.

There are two types of banks in general: commercial banks (conventional banks) and Islamic banks. In Jordan, they have both types of bank but there are some differences in terms of the regulations that govern these banks and the external and internal operations and tools used, especially concerning ALM and risk management.

Mun and Thaker (2017) investigated the impact of ALM on the financial performance of 12 Malaysian banks from both types – six conventional six banks and six Islamic six banks – during the period from 2010 to 2013. They used return on equity (ROE) as a measure for bank profitability, and employed the following variables: liquidity, capital adequacy, management efficiency, asset quality, size of bank, earnings quality and degree of risk aversion. From the outcomes obtained from correlation and regression analysis, they concluded that a positive relationship exists between ALM and banks' financial performance. Hence, ALM significantly affects the profitability of both types of banks conventional and Islamic. They also noted the difference in findings for both bank types, and this difference was attributed to the different operative methods employed by each type. For instance, the Islamic banking system has to comply with Shariah law, which among other things prohibits Riba. This unique asset and liability structure causes Islamic banks to face more risks than conventional banks. In addition, owing to risk complexity from the nature of their business and the differences in financial products and services, the accounting standards and reporting methods for both systems differ as well. The asset and liability sides in banks describe the banks' operations and the risks that they face. The assets side represents the risk of the surrounding environment, while most risks stemming from business operations are revealed on the liability side. Aligning these risks is the main purpose of asset and liability management (ALM), as it provides quantifiable measures of risk and strategies to manage it (Choudhry, 2011).

A number of authors have studied the relationship between these sides over time. DeYoung and Yom (2008) studied the associations among and between asset and liability accounts, particularly looking at how the relationships changed between asset and liability accounts in US commercial banks over 1990-2005 . The study reported a weaker relationship between assets and liabilities among banks that intensively employ strategies of risk mitigation.

Furthermore, the authors indicated that the relationship appears to be stronger at large banks than at small banks. Moreover, they highlighted the shift of commercial banks in the US into non-traditional banking services in addition to the general shift from portfolio lending to securitised lending and contingent credit contracts. Consequently, these have produced streams of off-balance sheet income, which could decrease the dependency of banks on interest-based income while decreasing the impact of mismatch between assets and liabilities on the overall risk positions of banks. The development of banking activities and strong supervisory safety may have caused the decreased need for banks to practice strict ALM, weakening the link between assets and liabilities. Furthermore, over the past 20 years, they indicated that the structure of assets and liabilities possessed by banks should have become significantly more autonomous. However, the authors found no systematic empirical investigation regarding these phenomena.

The recent global financial crisis started in the US in mid-2007 as a result of increasing default rates. The unfolding of the crisis cast into doubt the very survival of many financial institutions (ADB, 2009). Therefore, ALM became crucial to keep the financial system going, and to govern the business lines in these financial institutions. In Nigeria, Toby (2010) studied the management practices of a bank after the 2007/2008 Global Financial Crisis. They concluded that the meltdown of the Nigerian stock market had a significant influence on liquidity profiles in most Nigerian banks.

Toby (2010) used a questionnaire and interviews to gather their data while the respondents were senior risk managers from 24 Nigerian deposit money banks. These Nigerian banks all had constrained balance sheets due to the loose monetary policy regime in the country, which is characterised by substantial decreases in monetary policy rate, minimum liquidity ratio, and cash reserve ratio. Moreover, the majority of the banks were focused on expanding their asset

base and thereby needed to control the funds source. The banks' funds management strategies were subject to liquidity and capital constraints, minimization of loan loss provisioning, and dealing exclusively with default risk on loans. The current management strategy in dealing with chronic liquidity and solvency problems still relies on accessing the inter-bank market, while strengthening and reviewing the banks' specific contingency plans. The 2007-2008 Global Financial Crisis led to a reduction of capital inflows and investments in the Nigerian stock market, producing a 'confidence trap' and a build-up of non-performing margin loans. Somehow, after the global crisis, these banks depended more on purchased funds to meet their liquidity requirements. There are internal issues that impact good corporate governance in banks in Nigeria, including: weak risk management, difficulty changing management, conflicts of interest, non-existent dependable mechanisms for the board to obtain information, and unclear pay of directors. Toby's (2010) study suggested improving the monitoring ability of the regulatory agencies and the pertinent professional bodies. This would minimize the abuses of corporate governance. In addition, they indicated that in surviving the global financial crisis, banks in Nigeria were plagued with high documentation of prudential violations and disclosure lapses. Banks in Nigeria do adopt IFRS as industry best practice but this only happened after the crisis had already occurred (Toby, 2010).

Alam and Masukujjaman (2011) critically examine risk management practices in Bangladesh (types of risk facing the bank, procedures and techniques employed for risk minimization, etc.) among five commercial banks operating in the country. For each bank, five respondents were chosen, and therefore 25 respondents participated in the study altogether. Data were gathered using the questionnaire method. The authors found credit risk, operational risk and market risk as the banks' major risks. Accordingly, the risks are handled via three layers of management system; the main risk oversight is the responsibility of the board of directors; the executive

committee monitors risk; while all banking activities are overseen by the audit committee. The study further revealed that the banks employ a credit policy with the approval of their board of director and a credit risk management division for their credit risk management. The credit division execute their activities autonomously. The overall credit risk status is directly reported to the board/audit committee by the division of internal control and compliance. In liquidity risk management, that assurance of liquidity can preserve the confidence of customers. In addition, in terms of the application of risk management techniques among these banks, internal rating systems and a risk-adjusted rate of return on capital were the important techniques used by banks (Alam & Masukujjaman, 2011).

3.2.2.4 Asset Liability Management in MENA countries

Over the last decade, many countries in the MENA region have started to implement a number of structural reform programs. The financial sector in general and the banking sector in particular have not been isolated from these reforms, which were directed at preserving the stability of the financial system. The speed and magnitude of these reforms differed between the MENA countries, which resulted in deferent characteristics of the banking industry developing in these countries, with each one's procedures and policies that charted the attitude of these financial institutions having been affected by individual regulatory and political developments (Abed & Davoodi, 2003). The environment of financial institutions became much more dynamic after the global financial and economic crisis, and this uncertain market called for a well-designed financial safety net to prevent further crises and ensure the soundness and stability of the financial system (Mokni, et al., 2015).

In the MENA region during the period from 2012 to 2013, Mokni, Echchabi and Taher (2015) examined the current risk management practices of Islamic and conventional banks. In this study, a total of 47 banks (24 conventional and 23 Islamic) were selected as a sample, and a

questionnaire was used to collect data, which comprised close-ended questions and a five-point scale. The study concluded that the banks in MENA region have effective risk strategies and effective risk management frameworks as 83.3% of the conventional banks in the study had a formal risk management system in place, while 87.5% of the conventional banks had a committee/section responsible for identifying, monitoring, and controlling different risks. Additionally, for both conventional and Islamic banks, credit risk was found to be the most crucial, while liquidity risk was the second most crucial.

In term of the instruments used for managing liquidity risk, 87.5% of the conventional banks used central bank funds extensively, followed by cash reserves 75 percent and money market instruments 66.7 percent. The minimum used instruments were funds in other banks 45.8 percent. In addition, both types of bank depend on conventional instruments to mitigate credit risk.

Al-Mutairi and Naser (2015) conducted a study across the Gulf Co-operative Council (GCC) countries to find out the determinants of the capital structures of 47 commercial banks listed on those countries' stock markets over the period 2001 to 2010. They concluded that both profitability and liquidity impact the capital structure decisions of banks, and that most of these banks were financed by debts, accounting for more than 80% of these banks' capital. The study revealed that long-term debts are crucial in the financing of commercial banks in GCC.

Additionally, the relationship between the level of leverage and a set of explanatory variables regarding the capital structure of GCC banks was examined. Here, the study obtained the capital structure determinants from the previous literature as follows: tangibility, bank growth, liquidity, risk, profitability, size, and bank age. Based on the obtained ROA, tangibility and size, there is a negative and statistically significant relationship between the capital structure of GCC banks and their profitability. On the other hand, a positive and statistically significant

link was found between the capital structure and age and growth of GCC banks (AL-Mutairi & Naser, 2015). These relationships are important for policy makers for the development and management of balance sheets, and for financial planning for banks.

Al-Tamimi and Al-Mazrooei (2007) studied the use of risk management practices and techniques among banks in the UAE regarding handling different risk types. The compared two groups of banks in terms of their risk management practices. The study used three categories of banks (eight conventional, four Islamic and five leading foreign banks) and employed a two-part questionnaire as the data collection tool. The first part contains 43 items that represent the constructs of understanding risk and risk management; risk identification; risk assessment and analysis; risk management; risk monitoring practices and credit risk analysis. The second part contains two items on risk identification methods, and the risks facing banks in the UAE.

The study found the three most crucial risk types that UAE commercial banks are facing: foreign exchange risk, credit risk, and operating risk. In addition, the study noted an acceptable efficiency of UAE banks in their risk management. The most important variables in the practices of risk management for these banks are risk identification and risk assessment and analysis. Notably, for the large majority of the banks (90%), the four most crucial risk identification methods are as follows: inspection by risk manager of the bank, audits, analysis of financial statements, and risk survey. In addition, they found that the national and foreign banks of the UAE significantly differ in terms of their risk assessment practice and analysis, and in their risk monitoring and controlling. In addition, they recommended further researchers to study liquidity risk management in the UAE given that liquidity positions affect the stability of banks, and since risk management practices are primarily impacted by specific factors

including economic conditions, competition and regulations and financial planning – topics of great interest in the banking industry .

In Bahrain, Abu Hussain and Al-Ajmi (2012) attempted to determine if risk management practices have a significant link with bank type (i.e. conventional or Islamic) and explored if those practices positively affected the notion of risk, risk management, risk identification, risk assessment analysis, risk monitoring, as well as credit risk analysis in banks. They used three categories of banks (8 conventional, 4 Islamic, and 5 leading foreign banks) – a similar sample to Al-Tamimi and Al-Mazrooei (2007). They also selected a number of bankers from all staff levels in addition to risk management specialists as their sample, and employed the questionnaire as their instrument for data-gathering. They deduced that there was clear understanding of risk and risk management among banks in Bahrain. They also found that the banks were practicing efficient risk assessment analysis, risk monitoring, credit risk analysis, as well as risk management. Furthermore, they found that the conventional and Islamic banks in Bahrain use more traditional methods of risk identification than sophisticated methods. The most important risks that faced both types of bank are credit, liquidity and operational risk. In addition, they noted a significant difference between Islamic and conventional banks in terms of their understanding of risk and risk management. In particular, the risk levels that Islamic banks were facing were considerably higher than conventional banks. For liquidity, risks may be the result of a lack of active markets for Islamic Sharia'a-compliant money market instrument as well as restricted access to short-term financing, such as that from the central banks (Abu Hussain & Al-Ajmi, 2012; Mun & Thaker, 2017) .

In Tunisia, Selma et al. (2013) examined the current practices and techniques of risk management of 16 banks. The self-administered questionnaire method was used to gather the data. In particular, this study attempted to understand the viewpoints of bankers in Tunisia

regarding the importance of transparency and public disclosure, while also attempting to gain knowledge of the banks' risk profile. This study gained a 100% response rate with all 16 banks completing the questionnaire.

This study noted considerable awareness among Tunisian bankers regarding the importance and role of effective risk management in decreasing costs and enhancing performance. In addition, they reported that the risk strategies and risk management frameworks that these banks employed were effective. They indicated that credit risk exposure methods were being underutilized by banks in Tunisia but that liquidity risk management analysis was strong and several liquid instruments were in use. Furthermore, collateral and guarantees for supporting credit facilities were the most popularly employed methods of risk mitigation amongst the Tunisian banks. They concluded that Tunisian banks do not use market value at risk (VAR) extensively as a tool to mitigate against market risk.

3.2.2.5 Asset Liability Management in Jordan

Within the financial industry, the banking sector is one of the most vital sector supporting sustainable economic development in Jordan. However, to the best of my knowledge, no other researchers have as yet described or evaluated the ALM process in Jordanian banks. Available research that took into account Jordanian banks mainly investigated the impact of various internal and exogenous factors on liquidity and credit risks as well as profitability. For instance, Al-Afeef and Al-Ta'ani (2017) tested the impact of liquidity risks, credit risk and interest rate risk on the stability of the Jordanian banking sector during 2005-2016 for ten conventional banks. Their results found a statistically significant impact for liquidity risk and interest rate risk on the stability of the banking sector, and no statistically significant impact of credit risk. The study recommended that banks should give risk management much more attention, and that banks try harder to monitor their assets as well as general economic conditions carefully.

Al-Tamimi and Obeidat (2013) studied and identified important factors that determine the capital adequacy of commercial banks in Jordan on the Amman Stock Exchange over the period 2000 - 2008 using Multiple Linear Regression Analysis and the Correlation Coefficient (Pearson Correlation). They show a significant relationship between capital adequacy and liquidity risks, interest rate risks, ROE and RIA, as well as a significant relationship between capital adequacy and the following independent valuables: capital risk, credit risks and revenue power. While there is a positive correlation and direct significant relationship between capital adequacy and liquidity risks, RIA, there is a negative correlation and negative significant relationship between capital adequacy and RoE, and interest rate risk. Furthermore, a negative non-significant correlation exists between capital adequacy and the following independent variables: capital risks, credit risks and revenue power (Al-Tamimi & Obeidat, 2013). Refer to Appendix 1, Table 38 for a summary of the main studies that investigated assets and liabilities. The next section defines the common risk measurement techniques used by financial institutions.

3.3 Risk Measurement Techniques

The reports that are submitted to the ALCO from various departments use various financial ratios and indices as measures for risks. The ALCO uses these to set limit exposures for various risks. These feed into the banks' strategic plans and are reflected in their contingency plans as well as in their stress-testing exercises. The measurement of banks' exposure to diverse types of risks can be carried out using several techniques including gap analysis (maturity gap analysis, duration gap) value at risk, simulation, etc. the study will discuss them in the following sections.

3.3.1 Gap Analysis

Gap analysis is considered a crucial part of the content of ALCO reports as it is mainly used to measure the effect on the bank's net worth of changes in interest rates as well as the cash difference or gap that exists between the absolute values of the bank's assets and liabilities, which have sensitivity to movements in interest rates as shown below.

3.3.1.1 Maturity Gap Analysis

Maturity gap analysis encompasses the measurement of cash differences or a gap that exists between absolute values of a bank's assets and liabilities, which are sensitive to movements in interest rates (Choudhry , 2018). This analysis technique measures the comparative sensitivities to interest rates of both assets and liabilities. Hence, the risk profile of the bank is ascertained in terms of its reaction to changes in rates. The calculation of gap ratio is as below:

$$Gap\ ratio\ = \frac{\text{Interest rate sensitive assets}}{\text{Interest rate sensitive liabilities}}$$

In this regard, a gap ratio with a value greater than one denotes that an increase in interest rates will cause the net present value of the bank to increase. Hence, the return on assets is increased at a rate that is greater than the increase in the cost of funding. In turn, the spread of income will become higher. On the other hand, a gap ratio that is less than one denotes that funding costs increase (Choudhry , 2018). Traditional gap analysis is deemed appropriate for measuring liquidity risk arising from an incongruity in the maturities of assets and liabilities. Liquidity risk is measurable through the computation of gaps over diverse time intervals as on a date specified. Gaps are computable as the dissimilarity between rate-sensitive assets and rate-sensitive liabilities. For each maturity bucket, the liquidity gap is evaluated for a bank's risk of liquidity (Vij, 2005). Gap analysis encompasses a technique for ALM applicable in the assessment of banks' interest rate and liquidity risks (Charumathi, 2008). Vij (2005) indicated

that gap analysis gauges the control as well as the mismatch between both sides. In addition, management of active gap needs all markets in which an institution operates to be monitored; interest rate forecasts thereby become the determiner of active asset/liability management.

3.3.1.2 Duration GAP

The analysis of duration gap measures the effect on a bank's net worth of changes in interest rates. This analysis concentrates on changes in the market value of assets and liabilities. Accordingly, the duration gap is expressed as follows:

$$Duration\ gap = Duration\ of\ assets - W\ (Duration\ of\ liabilities\ )$$

In the above expression, W denotes the percentage of assets funded by liabilities. For this reason, Choudhry (2018) stated that the duration gap measures the effect of a change in interest rates on a bank's net worth. A higher duration gap denotes higher exposure to interest rates. As explained in Beck et al. (2000), a bank's net worth is equivalent to its assets minus its liabilities. In addition, the authors mentioned that the equalization of duration of assets and that of liabilities enables bank to immunize their net worth against changes in interest rates. In this regard, the aim is to make the duration gap (duration of asset portfolio minus that of bank liabilities) to be near zero as much as possible. Hence, a duration gap facilitates a bank's understanding of the impact of interest rates on their financial standing in order to avoid risks (Beck, et al., 2000).

3.3.2 Value at Risk

Value at risk (VaR) encompasses the expected worst loss over a given horizon at a certain level of confidence (Jorion, 1996). As discussed in Engle and Manganelli (2001), VaR encompasses a methodology for the estimation of the market risk that a bank is exposed to, and it is expressed

as the maximum potential loss in terms of the value of a portfolio owing to adverse movements market for a specified probability.

Conceptually, VaR is simple. It decreases the market risk that is linked to any portfolio to a singular number – namely the loss that is related to a specified probability (Engle & Manganelli, 2001). Engle and Manganelli (2001) also advocated the use of VaR to decide on the minimum capital required by bank in handling risk, and VaR is currently a standard measure employed by financial analysts in the computation of market risk. VaR models have long been employed by leading US banks and international banking authorities to determine market risk capital requirements by way of the 1996 Market Risk Amendment to the Basel Accord. Consequently, VaR is now a standard financial market risk measure for organisations both financial and non-financial (Berkowitz & O'Brien, 2002) .

In the management of market risks, Berkowitz and O'Brien (2002) indicated that leading financial bodies have created large-scale models for risk measurement. With regard to these models, the authors noted that they may employ different approaches but that they all fastidiously gauge and aggregate the current standing of market risks.

Employed as a statistical measure of risk exposure and the worst anticipated loss over a certain time interval under normal market conditions at a given confidence level of say 95% or 99%, VaR entails a dissemination of plausible outcome of future losses, which may happen to a given portfolio (Raghavan, 2015). In this regard, the real outcome will remain unknown until the event occurs, and while the actual event is still being anticipated, VaR will be a random variable with estimated outcome. According to Raghavan (2015), banks commonly use VaR models for market risk, advanced modelling approaches for credit risk as well as advanced approaches of measurement for operational risk.

3.3.3 Simulation

Simulation encompasses a procedure that measures the possible effect on a banking book from a given change in interest rates and/or a change in the shape of the book itself. It therefore measures users' levels of earning; this method can effectively cover both assets and liabilities (Choudhry, 2011).

Bessis (2002: p.193) defines simulation as a process "*that model(s) the behaviour of the balance sheet under various interest rate scenarios to obtain the risk and the expected target variables, interest income or the mark–to–market value of the balance sheet at market rates".* In general, the techniques of simulation evaluate in detail the probable impacts of interest rate changes on earnings and economic value (BOI, 2013). The forthcoming path of interest rates in addition to their effect on the flows of cash is simulated. Somehow, simulation generally involves a more in-depth analysis of various categories of on and off positions of the balance sheet. This enables the incorporation of certain suppositions regarding interest and principal payments and non-interest income and expenses, which emerge from each position type.

Techniques of simulation can also integrate changes in the interest rate environment that are more refined and varied. Accordingly, in a static simulation, cash flows from just the existing on- and off-balance-sheet positions of a bank are evaluated. In the evaluation of earnings exposure, simulations are carried out to estimate the cash flows and resultant streams of earnings over a period specified. One or more assumed interest rate scenarios are employed. A change in a bank's approximate economic value can be computed after the resultant cash flows have been simulated over all of the projected lives of the bank's holdings and discounted back to their current values. Meanwhile, in the dynamic simulation approach, more in-depth suppositions regarding the forthcoming path of interest rates and projected changes in the bank's business activity over time are applied. For example, the simulation could include

presumptions regarding the strategy used by a bank in changing its administered interest rates; the behaviour of its customers; and/or the stream of business to be faced by the bank in future. These presumptions regarding future activities and reinvestment strategies are employed in projecting anticipated cash flows and estimating dynamic earnings and economic value outcomes.

3.3.4 Stress testing

Central banks are requiring many banks to implement stress tests in order to ensure their stability in both the short term and the long term. The main aim of these tests is to ensure that banks can continue their operations under severe scenarios. It usually involves the stimulation of what could occur in a worst-case setting, often drawing on historical events or crises for reference (Bessis, 2015). Stress testing for banks is a vital tool of risk management, and this testing has become part of banks' internal risk management (BIS, 2009). It assesses bank's financial position under a harsh but conceivable scenario for facilitating a bank's decision-making. Stress testing equally refers to the mechanics of using certain individual tests, as well as to the bigger setting where the tests are created, assessed and utilised in decision-making processes. Equally, it is a supplementary tool for other approaches and measures of risk management. The authorities can also employ stress-testing in their quantification of the impacts of the stress test result in the plausible negative shocks could have on the capital positions of banks as a regulatory measure (BIS, 2009).

Accordingly, stress tests can be carried out using two approaches: bottom-up and top-down. The former involves the use of a bank's own internal models while the latter involves the application of the regulatory authorities' own models. The main advantage of the former is that it allows for better comprehension of the specified outcome drivers for individual banks, considering that the internal models of banks capture the idiosyncrasies of each institution. On

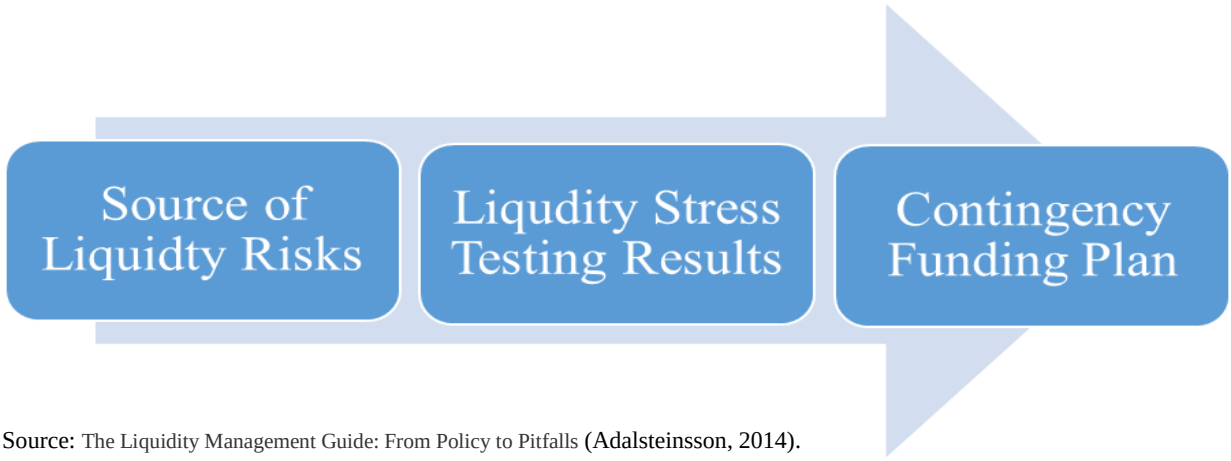
the other hand, the latter's main advantage is that it allows for the comparison of results across banks as it employs common models for different bank tests (Anand, et al., 2014). This way, authorities can understand different banks' respective susceptibilities to similar shocks (Anand, et al., 2014). Furthermore, banks should conduct stress testing on a regular basis and design scenarios in both the short and long term at both the banking level and market-wide, and individually and in combination (BIS, 2008).

Stress-testing starts with specific hypothetical scenarios. These scenarios tend to incorporate paths for economic and financial market conditions, and could be predicted to have an adverse impact on banks. Diverse techniques are used to estimate the effect of the scenario on banks' balance sheets (Dent, et al., 2016). Banks then have to consider different scenarios regarding their liquidity positions and risk and review the assumptions underlying their decisions concerning their funding positions on an annual basis (FCA, 2019). Therefore, the baseline projections can provide information about the banks' proposed strategies for the coming years and might be a benchmark that could be used in analysing results under the hypothetical stress (Dent, et al., 2016). Consequently, the scenarios should be proportionate with the nature and complexity of each bank's activities, as well as its liquidity risk exposure.

These scenarios must address off- balance sheet items and other contingent liabilities. Stress tests should be applied on a regular basis to identify a bank's current liquidity exposure; to confirm the liquidity risk tolerance established by that bank's governing body; and to analyse the separate and combined effects of potential future liquidity stress on the bank's liquidity position and cash flow as well as solvency (FCA, 2019). Stress test reviews should take into account changes in the market conditions and changes in the complexity of banks' activities/business model (FCA, 2019). Moreover, the authorities must conduct stress tests on the banking system as whole to determine its stability and preserve its resilience. The result

can be used to shape banks' hedging policy; to indicate financial stability risks; and to estimate individual banks' capital requirements (Dent, et al., 2016).

Figure 13 : The link between source of liquidity risks, stress testing and CFP



Source: The Liquidity Management Guide: From Policy to Pitfalls (Adalsteinsson, 2014).

The sources of liquidity risk that identifying by banks using as a base stone for stress testing model to ensure all or a part of sources being stress tested to shape the CFP to dealing with the stress conditions scenarios , and using the outcome to adjusted the overall liquidity framework as shown in Figure 14 (Adalsteinsson, 2014).

3.3.5 Contingency Funding plan

During the Global Financial Crisis, banks that did not have proper liquidity management techniques suffered from shortages of liquidity and higher costs due to their inability to secure adequate funding resources. A bank's liquidity management process has to be sufficient to meet its daily obligations and cover its expected and unexpected normal operations. A general framework is needed for monitoring and identifying this liquidity process. A contingency funding plan (CFP) is a risk assessment tool used to address potential adverse liquidity events and to determine emergency cash flow requirements to mitigate again liquidity risk (FED, 2010).

Banks without a comprehensive framework, including a contingency funding plan, can face serious risks regarding their solvency and durability (BIS, 2008). After the market turmoil broke out, banks did not conduct stress tests that factored in the possibility of market-wide strain or the riskiness or duration of the disturbance, as their views were that these disruptions were implausible. In addition, the result of the stress tests was not linked appropriately with the contingency funding plans, and sometimes failed to consider the possibility of some funding sources closing (BIS, 2008). CFPs are rather different from bank to bank as there is no accepted view on their best structure (Stragiotti, 2009). Therefore, contingent plans evaluate bank's capacity to produce cash flow in order to meet its debt commitments and deposit withdrawals, or margin calls on collateral, when conditions become severe (Bessis, 2015). Consequently, the CFB is a policy and procedure that helps banks to address liquidity shortages in emergencies (BIS, 2008). In addition, the aims of a CFB are to ensure that a bank can prudently and efficiently manage unexpected liquidity fluctuations and minimize the needed for crucial liquidity in the short and long-term periods through estimating the liquidity needed under specific circumstances.

The effectiveness of the CFB as a liquidity management plan in emergency depends on the aspects that it covers such as the nature of the business activity and complexity, and the size of these activities and risk exposure (Ismal, 2013). Therefore, the stressed market conditions and ability of banks to gains additional funds from the central bank and other liquidity facilities should be taken into account when designing contingency funding plans, including as normal liquidity management operations and emergency liquidity positions. The CFP encompasses a range of actions that the bank might take in anticipation of certain bank-specific or general developments or as a result of them (FCA, 2019).

The contingency funding plan as an assessment and comprehensive evaluation tool for bank liquidity strengths and weakness, which supplements ongoing balance sheet monitoring and provides knowledge to help mitigate risks to protect the bank in an emergency or in its day-to-day business (Bryant, 2013).Therefore, a CFP must be reviewed on a regular basis, in general every three months, with the outcome reported to senior management or the board (DICO, 2018). For the most part, the contingency funding plan anticipates liquidity needs in three main ways: identifying, quantifying, ranking and analysing all the sources of funds depending on their priorities in both on/off balance sheets; determining strategies for assets and liabilities in order to match potential sources of cash flow and usage of funds in case of liquidity crises or shortages; and charting up an indicator to inform bank management of a particular limit for potential liquidity risks (BIS, 2008; Ismal, 2013). Therefore, the CFP effectively has to consist of alternative sources of funding the primary sources and the secondary sources, and includes a procedure for shortfalls in emergencies the high frequent of monitor ensure the effective of the action plan of the bank (DICO, 2018).

3.4 Research Hypothesis

Identifying elements of ALM frameworks at banks requires studying the structure of the banking system as well as the policies and procedures used to set banks' strategies to manage both sides of the balance sheet. Researchers have tried to identify the main elements of the ALM framework within the context of the banking industry. In addition, they have sought to emphasise the importance of the ALCO as the implementation arm of ALM strategies and policies in order to mitigate against various risks including fundamental risks and to maximise their operating income. ALM has garnered increasing attention over the past few decades due to the crucial role of banks in the stability of the financial system.

3.4.1 Asset Liability Management

The concept of the ALM was settled as strategy for a hedging reaction against the risk of financial institutions (Zawalinska, 1999). In addition, ALM is a comprehensive strategy that is based on assessment and managing banking institutions effectively to achieve their targets while mitigating against banks' exposure to various risks (Choudhry, 2011). Moreover, ALM is a vital issue for banks' strategic planning, assessment and management of endogenous financial operations and external risks (Tektas, et al., 2005).

ALM frameworks work to maximise profitability while mitigating against the effects of risk factors (Bessis, 2011). An ALM framework should be compatible with a bank's overall strategy (Charumathi, 2008). Further, any goals set for the ALM should be clear and take into account various types of risks that affect banking operations, which could be mitigated against through setting risk exposure limits and using various risk-mitigation tools (Zawalinska, 1999). Contingency funding plans are also useful in this regard, as are periodic stress tests.

The risks stemming from banking operations involve lending and trading activities (Chorafas, 2007; Choudhry, 2011) and ensuring the availability of funding to meet expected and unexpected future obligations. This can be done by broadening a bank's funding sources and ensuring that it has adequate reserve buffers to cushion any liquidity shortfalls. In addition, ALM strategies and policies should be reviewed periodically through comparing actual performance with projections (BIS, 2008; Vento & La Ganga, 2009; Drehmann, 2013). Nevertheless, the developments in liquidity management supervision set by the Basel committee have increased the regulatory burden for banks. Although ALM was identified in the Basel II pillars, Basel III introduced new management standards to strengthen internal and

regulatory supervision over liquidity management in the banking industry (Kubat, 2014). Furthermore, regulatory authorities are paying more attention to the ALM process.

Based on the aforementioned definition, the research main hypothesis is as follows:

Hypothesis (1): Jordanian commercial banks have an effective ALM framework

3.4.1.1 Asset Liability Committee

The implementation arm of an ALM framework, the ALCO, is key to managing the ALM process and charting strategies and policies for individual business lines as well as a bank's overall strategy. It does this by analysing the bank's lending margin, interest income, variance from last projections, customer business and future business by assessing projected returns, revenue and risk exposure (Choudhry, 2018). The ALCO also considers acceptable risk exposure levels, existing risk limits, and hedging policies.

The ALCO is dependent on reports from various units in the bank. Many ALM desks formulate their hedging strategy within the overall context of funding and liquidity policy. In addition, they also carry out scenario planning under micro and macro level market conditions and the latest short-term projections and evaluate selected strategies by compared targets with actual achievements (Bessis, 2011; Choudhry, 2012). Furthermore, the ALCO members meet on a regular basis to discuss recent developments in the bank's supported business lines and changes in the surrounding environment (Choudhry, 2018). The ALCO also provides comprehensive information to the board of the bank regarding the risks being run (ADB, 2009). Based on the aforementioned definition, the first sub-hypothesis is as follows:

Hypothesis (1:1): *ALCO is effectively involved in implementing ALM strategies and policies in Jordanian commercial banks.*

Therefore, the independence of an ALCO in managing various risks is a matter of operational safety (IFC, 2012). Their focus should not only be directed to liquidity and interest rate risk; rather they should have a broader view of the risks stemming from the business environment as well as the risks stemming from their own banking operations (Bessis, 2011; Choudhry, 2012). In addition, regulatory authorities may influence the output of the ALCO report through its legislative powers in supervising the banking sector (IFC, 2008).

3.4.1.2 Liquidity Risk Management

The inability to control surrounding environmental factors and their impact on business lines has compelled banking institutions to set up strategies and policies to mitigate against the impact of these shocks and benefit from existing opportunities (Choudhry, 2011) and to manage the liquidity risk that arises from maturity mismatches across assets and liabilities. It requires an understanding of a bank's day-to-day liquidity needs (Bessis, 2015). Commercial banks' strategies to effectively manage asset-liability components require a focus on various pillars. The first pillar is concerned with managing banks' liquidity positions; and the second pillar focuses on the risks stemming from day-to-day operations (Choudhry, 2011). Appropriate liquidity risk management has to be consistent with a bank's overall strategy and attention must be paid to daily liquidity operations.

Based on the aforementioned definition, the second sub-hypothesis is as follows:

Hypothesis (1:2): *Liquidity risk management in Jordanian commercial banks is consistent with the overall strategy of the bank and considers operational liquidity needs.*

3.4.1.3 Contingency Funding Plans

Contingency plans evaluate liquidity situations in terms of banks' capacity to produce cash flow to fulfil their debt commitments and deposit withdrawals, or margin calls on collateral when market conditions become severe (Bessis, 2015) . In addition, the CFP consist of policies, strategies, and procedures that serve as a scheme for a bank to address liquidity shortages in emergencies (BIS, 2008). Furthermore, the CFB aims to ensure that banks can manage liquidity fluctuations in short term or long term prudently and efficiently, and mitigate against urgent liquidity needs (Ismal, 2013). Moreover, the CFP provides a comprehensive assessment of banks' liquidity strengths and weaknesses, which supplements ongoing balance sheet monitoring and provides risk-mitigation knowledge that management can use to protect the bank in emergency situations and in its day-to-day activities (Bryant, 2013).

Effective CFPs provide alternative sources of funds and include procedures when shortfalls are encountered (DICO, 2018).

Based on the aforementioned definition, the third sub-hypothesis is as follows:

Hypothesis (1:3): *Contingency Funding Plans in Jordanian commercial banks focus on liquidity positions*.

3.4.1.4 Stress-Testing

Stress-testing is a vital risk management tool and has become part of banks' internal risk management processes (Basel Committee on Banking Supervision, 2009). In addition, authorities can employ stress testing as a regulatory measure to quantify the impact of negative shocks on banks' capital and liquidity positions (Anand, et al., 2014). Stress testing begins with specific hypothetical scenarios, which tend to incorporate economic and financial market

variables that might be expected to have an adverse impact on banks. Different techniques are used to estimate the impact of the scenario(s) on banks' profits and balance sheets (Dent, et al., 2016).

In addition, the banks' stress test together is more rigorous than the authority's stress testing expectations which cover all the banking aspects. Furthermore, the most prevalent source of bank stress-test scenarios are historical conditions and expert judgements, followed by the use of supervisory scenarios and statistical methods (BIS, 2012). Most banks review their stress-testing framework at least every two years, while most banks review it annually (BIS, 2012). Therefore, the stress test aims to measure and understand the ability of banks' to maintain a sufficient buffer to stay afloat under extreme scenarios (Iyer & Sahu, 2018). Based on the aforementioned definition, the fourth sub-hypothesis is as follows:

Hypothesis (1:4): *Stress testing scenarios in Jordanian commercial banks are efficient in terms of liquidity management.*

In research survey, the researcher employed various data-collection techniques, namely open-ended questions, closed-ended question, and a Likert-scale in order to have a broader view of the structure of ALM in Jordanian commercial banks. The next section will discuss the methodology and research design used in this research.

3.5 Methodology

The methodology of any research encompasses the approach applied by the expert or specialist in their accomplishment of a given research project. In the work of Bryman (2008), the term 'methodology' was described as the practices and techniques in the collection, processing, manipulation and construal of information whereby the information is then applied in testing

ideas and theories. A research methodology is a description of the framework of methods applied to data gathering, analysis, and presentation.

Research methodologies come in two types: quantitative and qualitative. The former reaches conclusions using numerical data such as by testing the relationship among independent and dependent variables. It requires data to be collected in order to allow for the quantification and statistical treatment of information. This will support or disprove alternate knowledge statements. The quantitative methodology has the primary purpose of explaining and examining a topic via the correlation of many variables (Creswell, 2003). Conversely, qualitative research focuses on words rather than quantification of data gathered (Bryman, 2016). Accordingly, Creswell and Clark (2007) explained qualitative methodology as comprising a set of research techniques for the purpose of interpreting a phenomenon. This section follows a quantitative research design, as the purpose of this research is to describe and evaluate the present framework of asset and liability management in Jordanian commercial banks. It also attempts to understand the risk-measurement tools applied.

3.5.1 Research Design

Bryman (2016) described the research design in providing structure for data gathering and analysis. Through its provision of the framework, the design of research functions as guidance all through the process of research from start to finish, enabling the completion of the work required. In conducting social research, its design should be determined first prior to data gathering and analysis.

Research design is classable in many ways and the classification is in accordance with the objective of the criteria of classification itself. In this regard, explanatory, descriptive, and

exploratory research are the three most common classes of research. Each is described as follows:

Explanatory research is the manner in which different independent variables are manipulated to ascertain how a dependent variable is impacted within an environment that is fairly controlled. This method looks into the relationships of cause and effect that occur among variables. Nonetheless, there are shortcomings of explanatory research such as high cost and administrative difficulties (Creswell & Plano Clark, 2007).

Descriptive research is mainly useful for a researcher attempting to illustrate something associated with characteristics, functions, or any phenomena. This type of research is performed to illustrate the presence of something. Utilizing this research, a researcher employs events of the past to clarify present discernible facts. This research is characterised by explicit hypotheses, which in this instance were constructed earlier. Hence, according to Bryman (2008), the research design for descriptive research appears to be more structured and comprises many planning methodologies.

Exploratory research offers comprehension of the issue that the researcher is addressing. This type of research assists the researcher in resolving an issue which has not yet been extensively researched. Therefore, the qualitative method offers an avenue for interpretative clarifications (Creswell & Plano Clark, 2007).

Taking into account the association between these research design types, it is not so simple for a researcher to select a research approach that is deemed the best fit. It is crucial that the design chosen is applicable to the scrutinised problem while the procedure of carrying out the research is parsimoniously practicable and realistically within reach. This implies the significant impact

of the study's nature and the accessible resources on the research design. The framework applied in this study includes the characteristic of descriptive research designs. Furthermore, the technique of survey is used in this study in order to understand the process of asset and liability management as well as the techniques and tools used to manage and mitigate types of risk in Jordanian commercial banks. As such, the researcher could explore the issue in question using the viewpoints of professionals in the industry. This chapter is descriptive, generated from the knowledge and findings of past works, as highlighted in the reviewed literature. Accordingly, this study has opted for the quantitative design.

3.5.2 Research Strategy

A research strategy is also a crucial research aspect and is associated with the manner in which the linkage between theory and empirical data can be established. In social research, the purpose of a research strategy is generally to link theory with empirical data, as can be seen in the social domain (Bryman, 2016). In social research, the two primary strategies of research employed are the deductive and inductive approaches. The deductive approach is concerned with developing a hypotheses based on a theory, and then drawing up the strategy of research to test those hypotheses (Wilson, 2014).

In addition, the researcher relies on what is known pertaining to a given domain as well as to the theoretical considerations regarding the domain, and they work to infer hypotheses to be test in empirically (Bryman, 2016). In deductive approach, as a starting point the researcher begins from thinking up a theory regarding the topic of study. They then narrow down into more specific hypotheses, which can be tested, and then these are narrowed down even further when collecting the observations to address the hypotheses. The researcher moves from the top down, hence this is informally known as the top-down approach. These ways lead the researcher to be able to test their hypotheses and they can approve or reject their hypotheses

accordingly (Creswell, 2003; Lewis, et al., 2012). Meanwhile, the use of the inductive approach begins with from precise observations or findings to a wider generalisation or theory. Inductive reasoning works the other way round from deductive approach, and moves from specific observations or findings to broader generalizations and theory. Informally, call this a "bottom up" approach. The researcher begins with certain observations or arguments, followed by the construction of tentative hypotheses for testing, and to finish, creates a general theory (Blaikie, 2007; Johnson, 2011; Myers, 2013). This research is focused on the descriptive approach, then, using the data gathered from the field, hypotheses are created and then tested using the gathered data. Therefore, a deductive strategy is appropriate for this study.

3.5.3 Research Method

The method of research encompasses the techniques, tools, and procedures deemed necessary for data gathering, analyses, as well as interpretation of the research venture (Bryman, 2016). In Creswell (2003), the notion of research method is viewed as the practices and techniques applied in the collection, processing, manipulation and interpretation of information, which are then usable for testing ideas and theories. The literature highlighted two kinds of research methods, namely quantitative and qualitative, where the former reaches conclusions according to numerical data, while the latter focuses on words rather than numbers. Furthermore, the quantitative method has a heavy reliance on statistical significance, whereas qualitative analysis primarily applies straightforward human ruling in the interpretation and organisation of the data gathered. As such, the qualitative method encompasses an assembly of research techniques applied in the interpretation of the phenomenon (Oppenheim, 2000; Greener, 2008; Lewis, et al., 2009; Bryman, 2016).

Quantitative measurement has been viewed as having a greater level of accurateness, reliability, validity, and objectivity as opposed to qualitative measurement. The focal points of

qualitative research are observations and words, visual portrayals, anecdotes, construal, as well as other expressive explanations. The use of qualitative approaches enables more diverse responses, and these approaches also could adapt to new changes or issues that emerge while the research is ongoing. It is somehow noted that qualitative research can consume a lot of time and money. Still, this type of research appears to be popular in numerous fields.

In this study, which is quantitative research, the questionnaire survey method has been chosen as the data-gathering tool. The survey questionnaire allows the researcher to obtain the appropriate answers to their research questions. In this regard, descriptive research is richer if it has a link to the literature review.

3.5.4 Data Collection

In the following sections, the specifics of the data collection methods are highlighted.

3.5.4.1 The Questionnaire

A tool for research comprising a sequence of questions aimed to capture information from respondents. This data collection tool has been widely used by many researchers because it can capture diverse types of primary data. These collectable data, as noted by De Vaus (2002), include data on motivation, attitude, behaviour, and on viewpoints regarding the topic under scrutiny.

The questions set for the questionnaire must address the study aims, and a questionnaire that shows its appropriateness for the research objectives and questions set by the study is an effective questionnaire. The questionnaire must demonstrate clarity and unambiguity, while also be able to stimulate participation from respondents (De Vaus, 2002; Robson, 2016). Surveys that are correctly devised and implemented can become an effective and accurate tool for the determination of information regarding a population under scrutiny. Surveys allow

fairly fast attainment of outcomes. Furthermore, depending on sample size of a study and the methodology selected, surveys can be cost-effective to use. According to De Vaus (2002), countless advantages have been linked to survey questionnaires as opposed to other data-gathering methods.

Accordingly, the advantages of questionnaires include: standardized gathering of responses, which makes questionnaire more objective in nature; convenience to respondents in terms of completion time; quick to complete; low cost to administer; respondents are free to be honest in responding to the questions; and bigger potential coverage of respondents. Meanwhile, Oppenheim (2000) discussed the issues that have emerged with the questionnaire method as follows: possible reluctance of certain respondents to provide responses to the questions; possible superficial answers given by the respondents, particularly when the completion time is too lengthy (the researcher should thus avoid presenting too many questions in the questionnaire); respondents giving biased opinions, which could compromise the validity of all responses; lack of opportunity to rectify misunderstandings or probe or assist the respondents; possible misinterpretation of respondents of certain items; and failure of respondents to responding to the questions, which might affect the reliability and rate of response of the survey overall.

Regardless, questionnaires have proven their usefulness and effectiveness in obtaining the data associated with the perceptions and opinions of banks on a given subject. Hence, a questionnaire survey is employed in this study to obtain the primary data from Jordanian commercial banks regarding their ALM practices. In this study, this method is one of the primary methods of gathering the main data.

3.5.4.1.1 Open- and closed-ended questions

Questions can be in the form of open-ended questions or closed questions. In particular, open-ended questions give participants freedom to respond any way they like. On the other hand, closed questions provide respondents with several answer options, of which they have to select one or more (De Vaus, 2002). Closed-ended questionnaires are simpler and faster for the respondents to respond to as they do not need to write any sentences in response. This type of questionnaire is also simpler to code. However, closed questions lack spontaneity and expressiveness. In addition, there is a possibility of bias as respondents are obliged to make a choice between several provided alternatives. Closed questions do, however, force respondents to concentrate on the options given (Oppenheim, 2000).

By contrast, there are several advantages associated with open-ended questions. This type of question stimulates respondents to provide responses according to their liking. According to Creswell (2003), open-ended questions generate information that is unobtainable through closed questions. Furthermore, open-ended questions allow respondents to provide answers based on their knowledge or level of expertise. However, as acknowledged by Oppenheim (2000), designing the coding framework and executing the coding process consumes a lot of time. For researchers, it is therefore advantageous to have only a small number of open-ended questions.

3.5.4.1.2 The characteristics of measurements

The three main levels of measurement scales, as mentioned by De Vaus (2002), are nominal scale, ordinal scale and interval/ratio scale. As explained by the author:

1 - Nominal scale is used in determining dissimilarity between categories of a variable but the categories cannot be ranked using any order. Nominal scale is useful in the measurement of

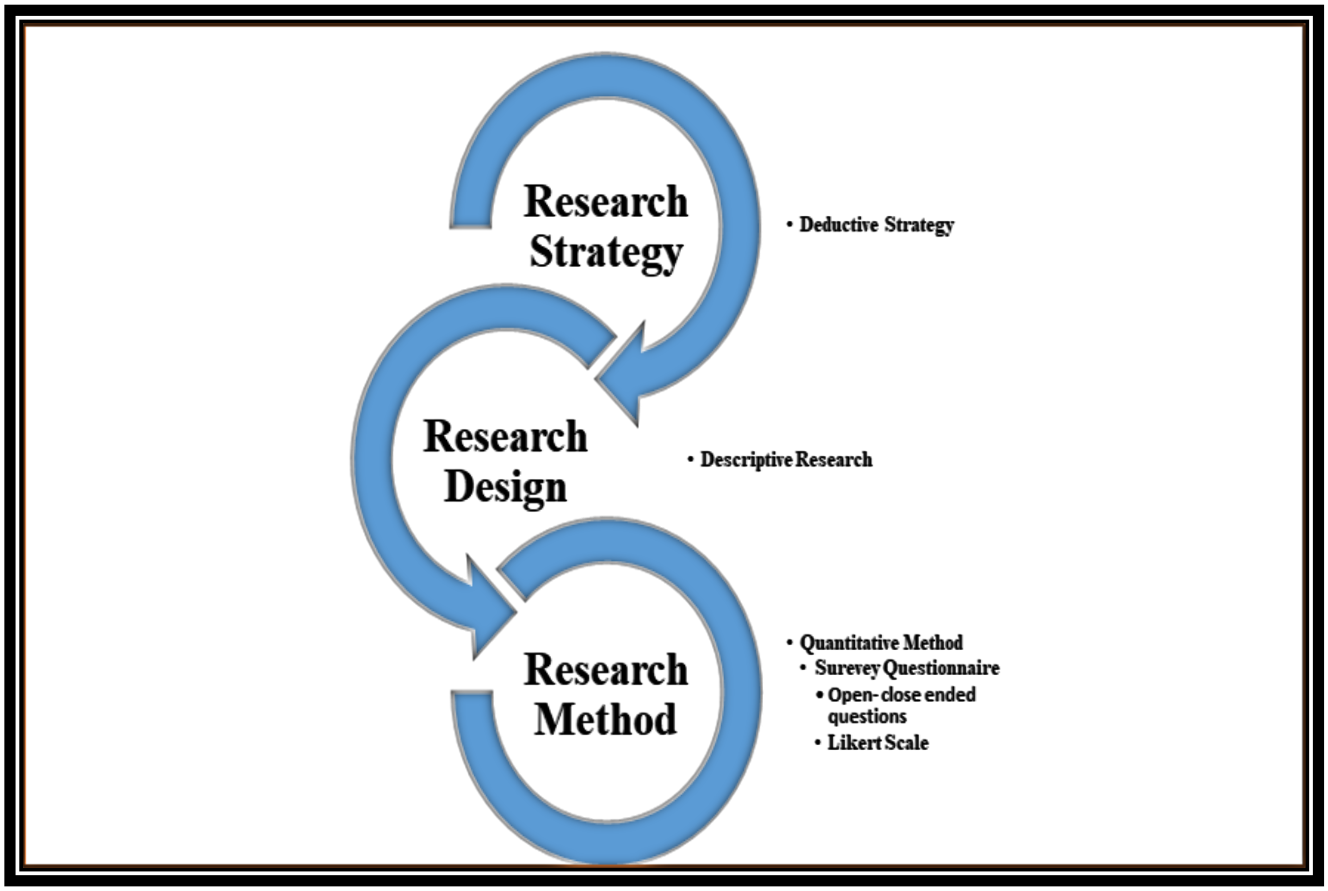
qualitative variables. This scale generates frequency data, which are suitable for non-parametric statistical tests.

2 - Ordinal scale is applied in answers that should be ranked using categories but these categories cannot be accurately quantified in terms of how much difference there is between them.

3 – The ratio or interval scale allows for the ranking of categories. Categories that are appropriate under this scale can be quantified in terms of the differences between them. Among the commonly used are Likert scales.

In this study, the researcher used multi categories of measurements appropriate to the questions. Figure 14 shows the research methodology that adopted for this research chapter.

Figure 14: Research Methodologies



Source: Author plot

3.5.4.1.3 Questionnaire Sample

Bryman (2016:174) stated that "*a sample is the segment of population that is selected to be investigation".* To represent an entire population, the size of sample in a study has to be adequate. The determination of sample size is dictated by the population's homogeneity; a larger sample is necessary if a pilot study shows significant population heterogeneity, while the study is mainly aimed at generalizing the results to the population and . In addition, sampling errors portability will be less in larger sample size (Robson, 2016).

There are many sampling strategies, including cluster sampling, panel sampling, simple random sampling, stratified sampling, systematic sampling, and so forth. Each strategy has advantages as well as disadvantages. Regarding the variety of sampling methods, Robson (2011) mentioned the possibility of using them separately or together. Accordingly, there are a number of factors that generally affect the selection of methods: the nature and quality of research; the accessibility of supporting information regarding the research units; the need for accuracy and accurate measurement; the possibility of the expectation of sample analysis; and issues associated with operation and/or cost.

The banking sector in Jordan comprises 25 banks, 4 of which are Islamic banks and the rest of which (21) are commercial banks. Thirteen of the latter are domestic banks while the rest are foreign. The study will focus on commercial banks operating in Jordan as Islamic banks are subject to different regulations, policies and procedures compatible with Shariah Law. Thus, non-probability sampling[20] is used to define the targeted population. Furthermore, the

[20] The inclusion/ exclusion of elements in the sample at the discretion of the researcher (Hair Jr, et al., 2011) .

researcher will try to administer the survey questionnaire to all of the conventional commercial banks in Jordan.

Table 2: The banking system in Jordan

Type of banks	No.	%	Notes
Total banks in Jordan	25	100%	Percentages of total population
Commercial banks	21	84%	
Islamic banks	4	16%	
Total sample; of which:	21	84%	
Domestic commercial banks	13	61.9%	As percentages of the total sample.
Foreign commercial banks	8	38.1%	

The survey questionnaire will contain descriptive questions that are designed to measure the characteristics of balance sheet management and the strategies used in relation to the role of the ALCO committee in Jordanian commercial banks. The targeted group will be carefully selected to ensure their involvement in the study subject. Thus, the questionnaire administered to the treasury managers or CEO depends on the degree of involvement and organisational structure of the Jordanian banks.

3.5.5 Questionnaire Design

The researcher mainly constructed the questionnaire based on deductions from the literature review as well as surveys on ALM within the banking industry and central banks. The researcher also drew on Choudhry (2011), the Basel committee standards, World Bank regulations, and materials from the Financial Conduct Authority for a theoretical foundation

and conceptual framework for the questionnaire. In particular, Choudhry (2011) classed the conventional approaches that the majority of financial services industries are using. Apart from that, the broad practical experience that has been gained by the researcher in central and commercial banking greatly contributed to the design process of the questionnaire.

The survey questionnaire covers seven main topics, namely; (I) Asset Liability Management; (II) Asset Liability Management Committee; (III) Liquidity Risk; (IV) Interest Rate Risk; (V) Credit Risk; (VI) Market Risk; and (VII) Contingency Funding Plans and Stress Testing (see Appendix 2-2). Furthermore, Figure 15 shows the topics covered in the survey questionnaire.

Figure 15 : Questionnaire Sections

Source: Auther plot

3.5.5.1 Ethical considerations

Researchers are professionally and legally accountable to their study respondents. Following the attainment of permission from the respondents' managers, the researcher was accountable for making sure that the respondents were clear about the survey in terms of its objectives. In

addition, the use of formal language in the questionnaire was needed to prevent discriminatory language. Furthermore, the researcher has to assume accountability for protecting the identity and identifiable information of individual respondents from being exposed to third parties such as clients and the public without express permission from the respondents themselves. Apart from that, the researcher is obliged to remain as objective as possible when performing their analyses (Greener, 2008).

Accordingly, the researcher will avoid using offensive, discriminatory, or other unacceptable language in the formulation of the questionnaire. In addition, the researcher will seek the permission of the senior management teams in the Jordanian commercial banks in study sample in order to identify the right respondents, alleviate any inconvenience for the respondents, respect their privacy and anonymity, and ensure that an adequate level of confidentiality is maintained regarding the research data. Furthermore, the researcher will ensure the transparency and clarity of the survey objective and maintain the highest level of objectivity in research analyses. During the questionnaire's distribution, the researcher contacted the central bank of Jordan, as it is the supervisory body for the banking sector in Jordan. They offered their help in distributing the questionnaire to all of the conventional banks in Jordan to get the feedback from the respondents.

3.5.5.2 Pilot study

This study was carried out prior to the execution of the main research study. The pilot study was to ascertain the feasibility of the research and was used to improve the research design. According to De Vaus (2002), a research questionnaire needs to be meticulously evaluated prior to final administration. A pilot test is therefore necessary owing to the fact that it brings to light any inadequacies prior to the full distribution of the document. As explained by Bryman (2016), a pilot study scrutinizes the general presentation, clarity and rationality of the

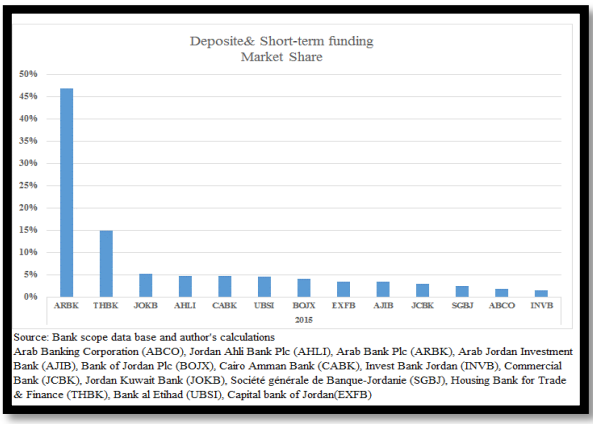
questionnaire, particularly with respect to the depth and length of the questions. In addition, the use of a pilot study allows the researcher to determine their respondents, and to determine if they respond to the questions correctly (Dillman, 2014). In this study, five commercial banks in Jordan were chosen as respondents of the pilot test. The proposed study sample for the pilot survey carried out in Jordan is presented below.

3.5.5.3 Pilot study sample selection scenarios

The study evaluated the ALM framework presently employed by commercial banks operating in Jordan. There are 21 commercial banks operating in Jordan, which means that the overall population is 21 in number. From these 21 banks, 13 are domestic banks and the remainder are foreign. Primary indicators reflecting profitability, quality of management and market share of commercial banks are used. Meanwhile, the random sampling method was run using Microsoft Excel to select the commercial banks that participated in the pilot study. Accordingly, Connelly (2008) suggested that the sample of the pilot study should account for 10% of the anticipated sample of the main study. The data employed was provided by the BankScope database based on the accessibility of bank data to make the sample of pilot study scenarios.

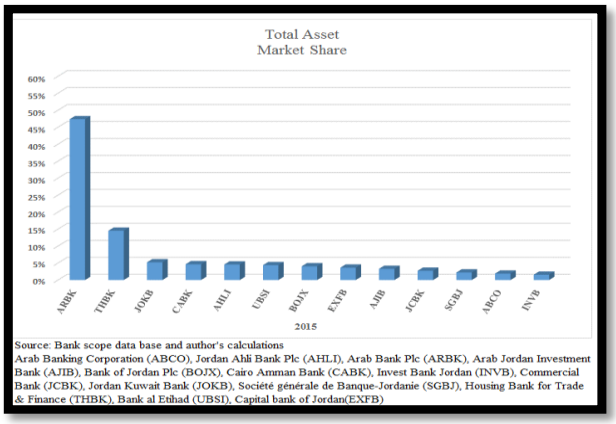
Figure 16 : pilot study sampling scenarios

Deposits and short term funding
(Market Share)



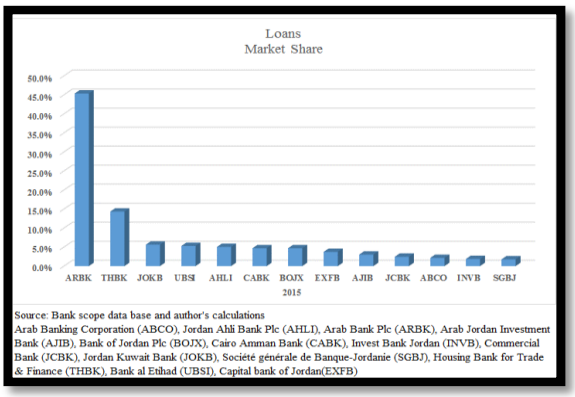
Source: Bank scope data base and author's calculations
Arab Banking Corporation (ABCO), Jordan Ahli Bank Plc (AHLI), Arab Bank Plc (ARBK), Arab Jordan Investment Bank (AJIB), Bank of Jordan Plc (BOJX), Cairo Amman Bank (CABK), Invest Bank Jordan (INVB), Commercial Bank (JCBK), Jordan Kuwait Bank (JOKB), Société générale de Banque-Jordanie (SGBJ), Housing Bank for Trade & Finance (THBK), Bank al Etihad (UBSI), Capital bank of Jordan(EXFB)

Total Assets
(market share)



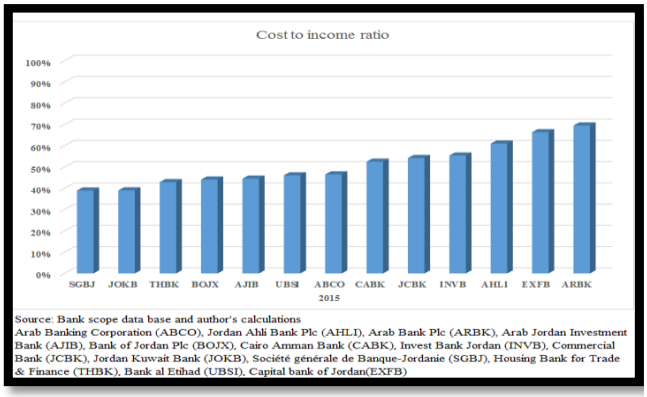
Source: Bank scope data base and author's calculations
Arab Banking Corporation (ABCO), Jordan Ahli Bank Plc (AHLI), Arab Bank Plc (ARBK), Arab Jordan Investment Bank (AJIB), Bank of Jordan Plc (BOJX), Cairo Amman Bank (CABK), Invest Bank Jordan (INVB), Commercial Bank (JCBK), Jordan Kuwait Bank (JOKB), Société générale de Banque-Jordanie (SGBJ), Housing Bank for Trade & Finance (THBK), Bank al Etihad (UBSI), Capital bank of Jordan(EXFB)

Loans
(market share)



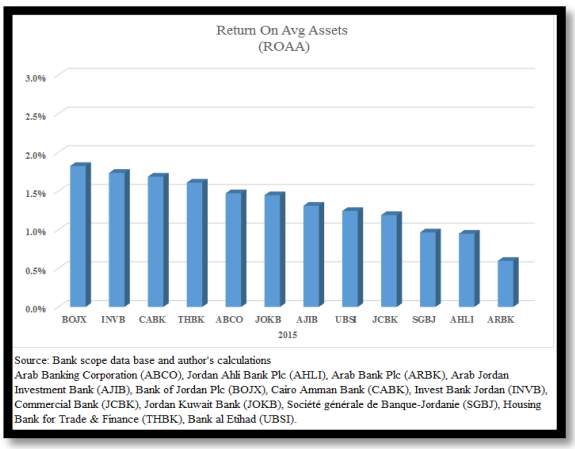
Source: Bank scope data base and author's calculations
Arab Banking Corporation (ABCO), Jordan Ahli Bank Plc (AHLI), Arab Bank Plc (ARBK), Arab Jordan Investment Bank (AJIB), Bank of Jordan Plc (BOJX), Cairo Amman Bank (CABK), Invest Bank Jordan (INVB), Commercial Bank (JCBK), Jordan Kuwait Bank (JOKB), Société générale de Banque-Jordanie (SGBJ), Housing Bank for Trade & Finance (THBK), Bank al Etihad (UBSI), Capital bank of Jordan(EXFB)

Cost to Income Ratio
(Quality of Management)



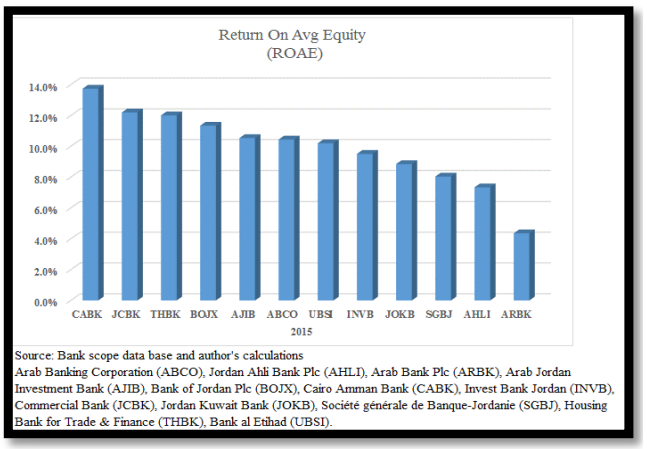
Source: Bank scope data base and author's calculations
Arab Banking Corporation (ABCO), Jordan Ahli Bank Plc (AHLI), Arab Bank Plc (ARBK), Arab Jordan Investment Bank (AJIB), Bank of Jordan Plc (BOJX), Cairo Amman Bank (CABK), Invest Bank Jordan (INVB), Commercial Bank (JCBK), Jordan Kuwait Bank (JOKB), Société générale de Banque-Jordanie (SGBJ), Housing Bank for Trade & Finance (THBK), Bank al Etihad (UBSI), Capital bank of Jordan(EXFB)

Return on Average Assets.
(Profitability)



Source: Bank scope data base and author's calculations
Arab Banking Corporation (ABCO), Jordan Ahli Bank Plc (AHLI), Arab Bank Plc (ARBK), Arab Jordan Investment Bank (AJIB), Bank of Jordan Plc (BOJX), Cairo Amman Bank (CABK), Invest Bank Jordan (INVB), Commercial Bank (JCBK), Jordan Kuwait Bank (JOKB), Société générale de Banque-Jordanie (SGBJ), Housing Bank for Trade & Finance (THBK), Bank al Etihad (UBSI).

Return on Average Equity
(Profitability)



Source: Bank scope data base and author's calculations
Arab Banking Corporation (ABCO), Jordan Ahli Bank Plc (AHLI), Arab Bank Plc (ARBK), Arab Jordan Investment Bank (AJIB), Bank of Jordan Plc (BOJX), Cairo Amman Bank (CABK), Invest Bank Jordan (INVB), Commercial Bank (JCBK), Jordan Kuwait Bank (JOKB), Société générale de Banque-Jordanie (SGBJ), Housing Bank for Trade & Finance (THBK), Bank al Etihad (UBSI).

Source: Author plot

Random Sampling

This study chose to use the random sampling method to select the pilot study sample. For this purpose, all commercial banks in Jordan were arranged based on their establishment date. Then, Excel was used to draw the random sample.

As already indicated, the suggested sample size is approximately 10% of the target population (Connelly, 2008), and in this study's context, it refers to two banks. Somehow, this study has opted to enlarge the sample to account for approximately 25% of the overall target population. This expansion of size is to assure consistency between the pilot study and the actual survey. Accordingly, the details of the pilot study sample comprising five banks are shown in the table below.

Table 3: Details of pilot study sample

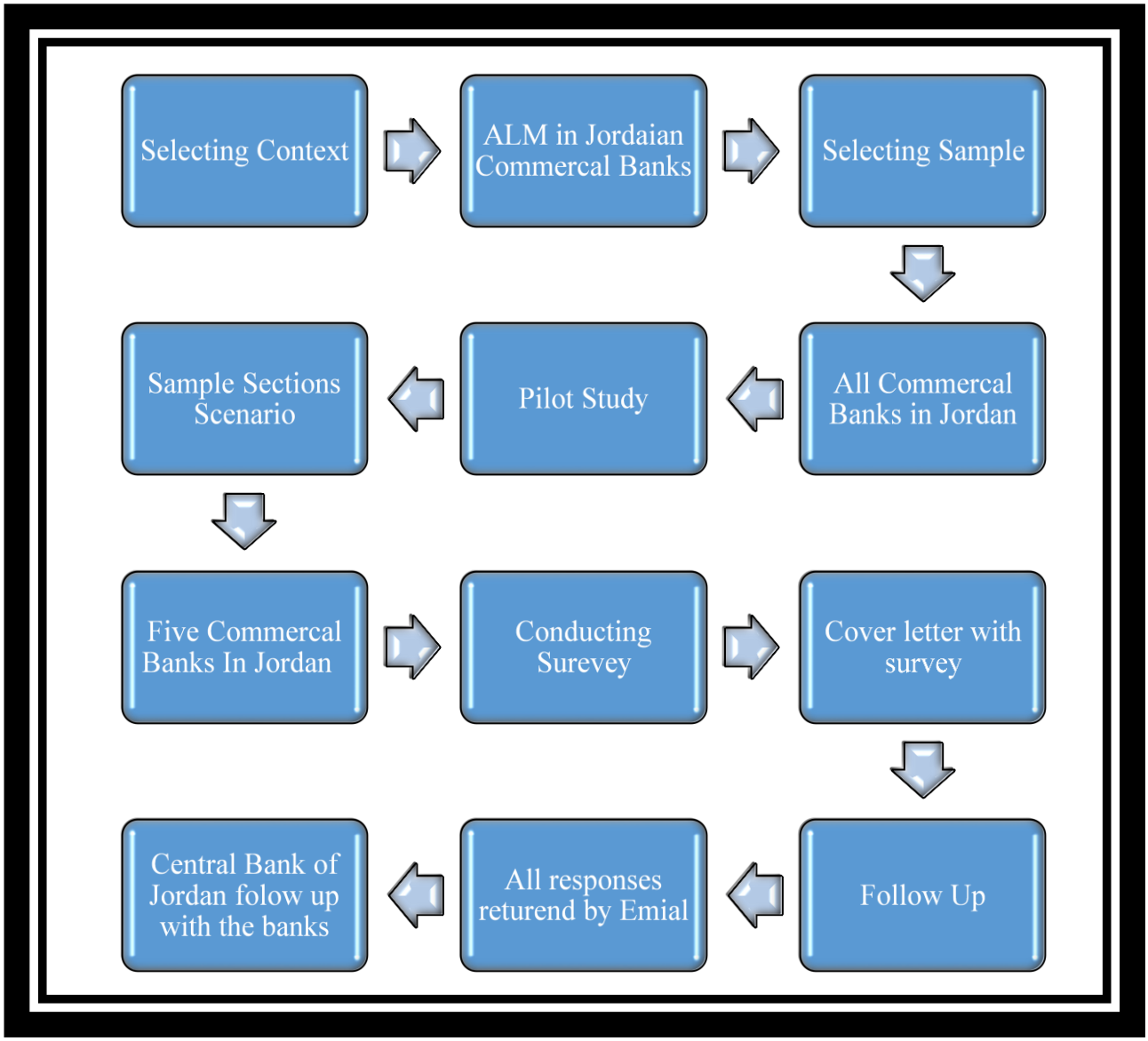
No.	1	2	3	4	5
Deposits	ARBK	THBK	JOKB	AHLI	CABK
Total Assets	ARBK	THBK	JOKB	CABK	AHLI
Loans	ARBK	THBK	JOKB	UBSI	AHLI
Cost to Income Ratio	SGBJ	JOKB	THBK	BOJX	AJIB
ROAA	BOJX	INVB	CABK	THBK	ABCO
ROAE	CABK	JCBK	THBK	BOJX	AJIB
Random Sampling	AHLI	EXFB	CABK	THBK	UBSI

Arab Banking Corporation (ABCO), Jordan Ahli Bank Plc (AHLI), Arab Bank Plc (ARBK), Arab Jordan Investment Bank (AJIB), Bank of Jordan Plc (BOJX), Cairo Amman Bank (CABK), Invest Bank Jordan (INVB), Commercial Bank (JCBK), Jordan Kuwait Bank (JOKB), Société Générale de Banque-Jordanie (SGBJ), Housing Bank for Trade & Finance (THBK), Bank al Etihad (UBSI). Source: BankScope database.

3.5.5.4 Data Validity and Reliability

Validity is a concept that relates to whether the questions in the questionnaire measure what they have been designed to measure. Validity relies on the degree of honesty and accurateness of the responses that the respondents provide and is not easy to measure. Conversely, reliability is a concept that relates to the consistency of the questions (De Vaus, 2002).

Figure 17: Data collection process



Source: Author plot

As mentioned in Oppenheim (2000), consistency, accuracy and explicability of outcomes are the primary constituents of data reliability. This implies the need for consistency during data collection. At the same time, the researcher should also attempt to achieve high precision and accuracy. All of these are affected by countless factors that are beyond the researcher's control. Furthermore, bias should also be minimized during data collection. Meanwhile, this study has attained tolerable data validity and reliability, helped by the success of the central bank of Jordan in distributing the questionnaire to the respondents and following them up. In addition, a cover letter was constructed in this study. It provides explanation regarding the purpose of the research while also providing assurance of confidentiality in terms of responses see Appendix 2-1. The responses to the questionnaires were also checked in terms of their consistency. Multiple questions were used to inquire the same point. Lastly, several relevant practitioners and academics were invited to offer their opinion regarding the proposed drafts and their would-be impact on the validity and reliability of the data.

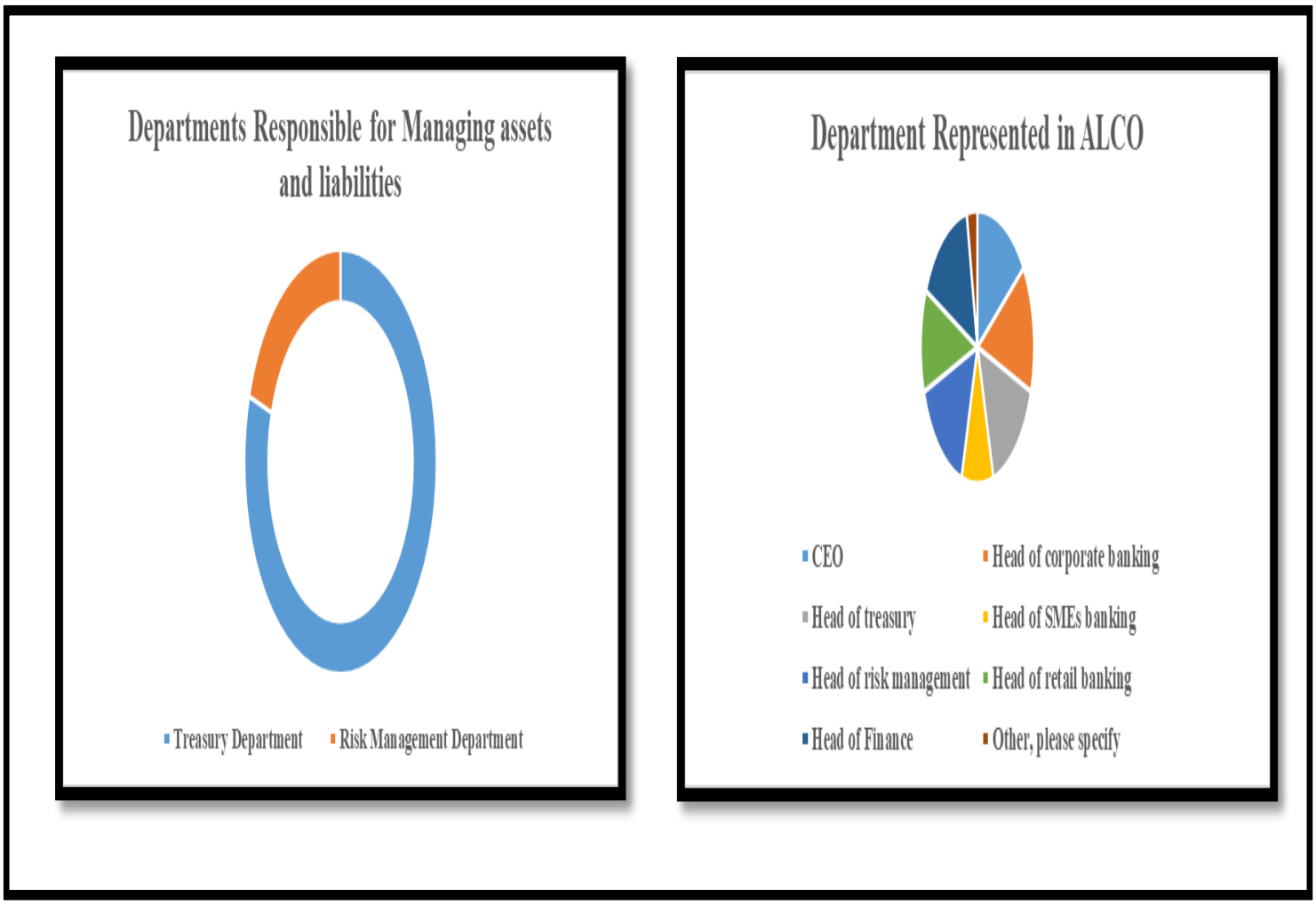
3.6 Pilot study results overview

The pilot study was useful in two main respects. It identified the main preliminary indicators and perceptions associated with the overall ALM framework that governs balance sheet management, risk metrics and perceptions at Jordanian commercial banks and the role of asset and liability committee in mitigating these risks. In addition, it provided useful feedback and pointers on the actual questionnaire structure and content, which helped in refining the final questionnaire before the full study commenced. This section presents the results of the pilot study that was conducted between June 2017 and July 2017 on Jordanian commercial banks. The primary elements of the pilot study are the organisational structure, asset liability management, the asset liability management committee, liquidity risk, interest rate risk, credit risk, market risk, contingency funding plans (CFP) and stress testing.

3.6.1 Organisational structure

The organisational structure of the respondents in the pilot study reveals that the treasury department bears the main responsibility for managing banks' balance sheet (80%), whereas 20% of the banks indicated that the risk management department is responsible for managing the banks' assets and liabilities. In addition, all of the banks indicated that they have an ALCO committee in their organisational structure. The results indicate that the CEO, Head of Corporate Banking, Head of Treasury, Head of Risk Management, and finance departments are part of the ALCO committee in all of the pilot study respondents. Figure 18 illustrates the organisational structure of the asset and liability management committee:

Figure 18: Organisational structure of the asset and liability management committee

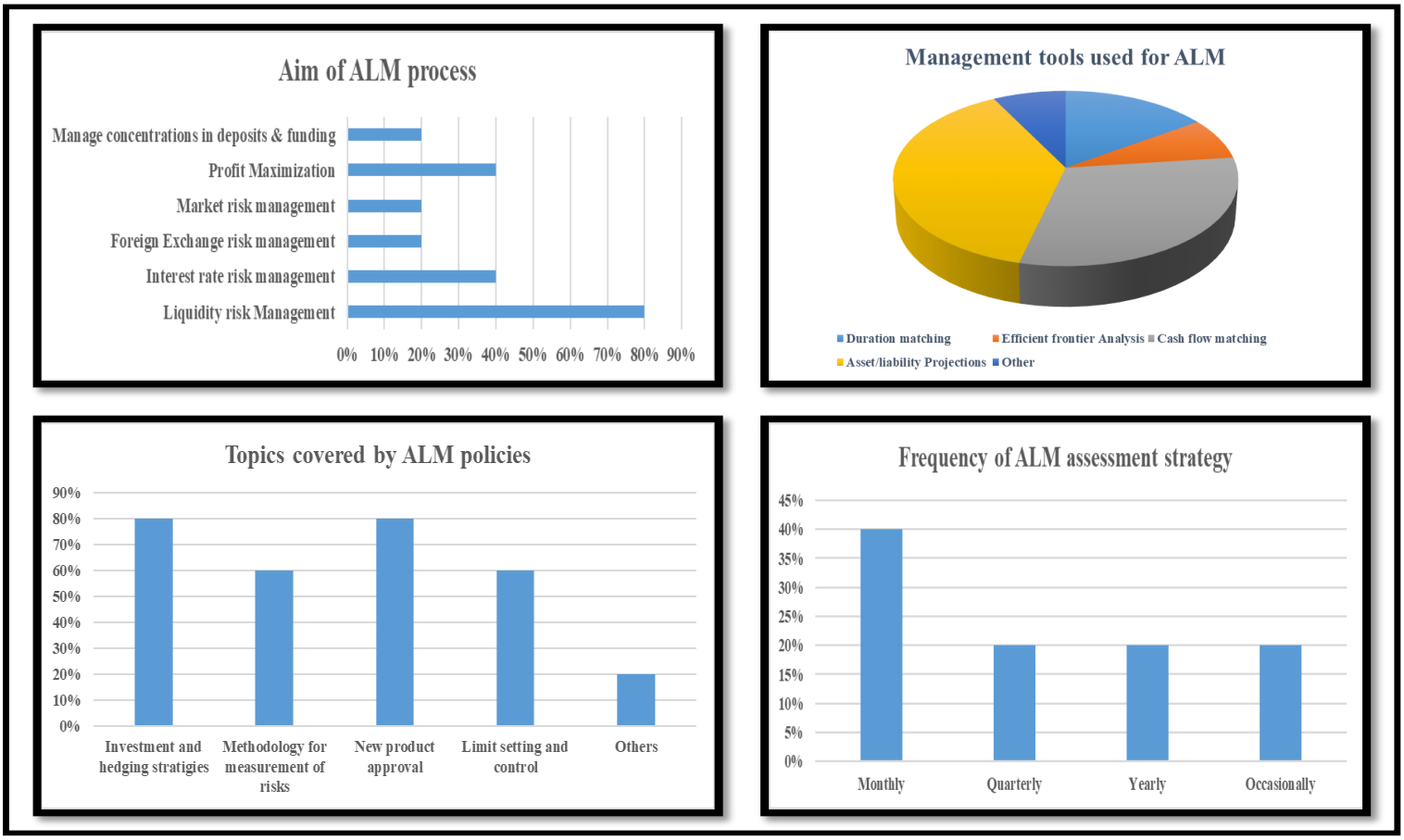


Source: Source: Pilot study results

3.6.2 Asset Liability Management (ALM)

All respondents in the pilot study sample indicated that an ALM process exists at their banks. In addition, they highlighted that the aim of the ALM process in Jordanian commercial banks is to manage liquidity risk and interest rate risk as these were ranked by the banks as the most important risks to be taken into consideration in the ALM process. The results also indicate that 80% of the ALM process at Jordanian commercial banks covers investment and hedging strategies and new product approvals, while 60% highlighted that ALM also covers methodologies for measuring risks and setting limits and controls and that various tools are used in ALM, including describing the evolution of balance sheet components and projections for assets and liabilities (100%), as shown in Figure 19.

Figure 19: ALM process and covered topics

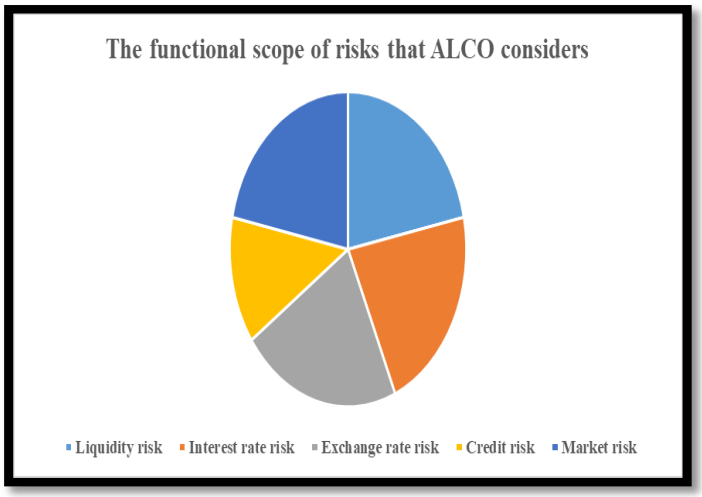


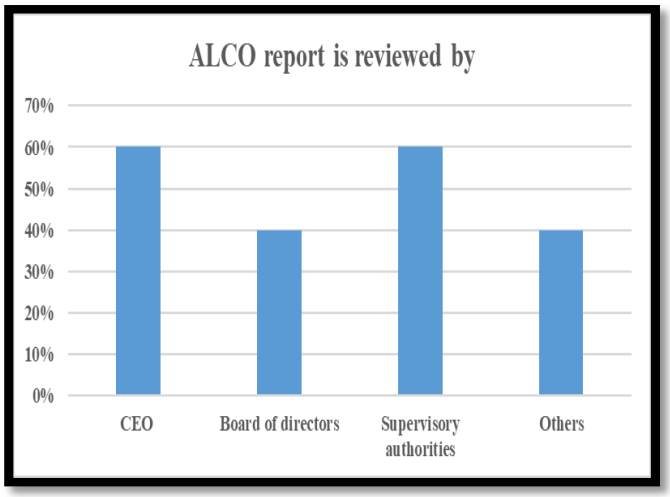
Source: pilot study results

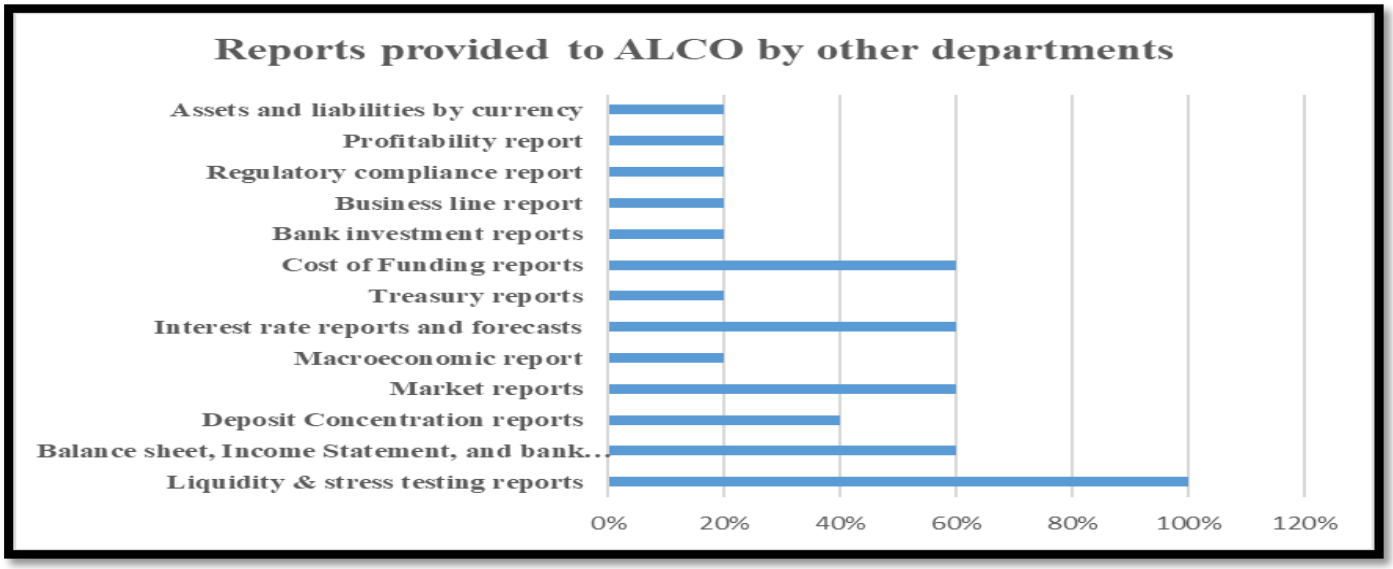
3.6.3 Asset Liability Committee

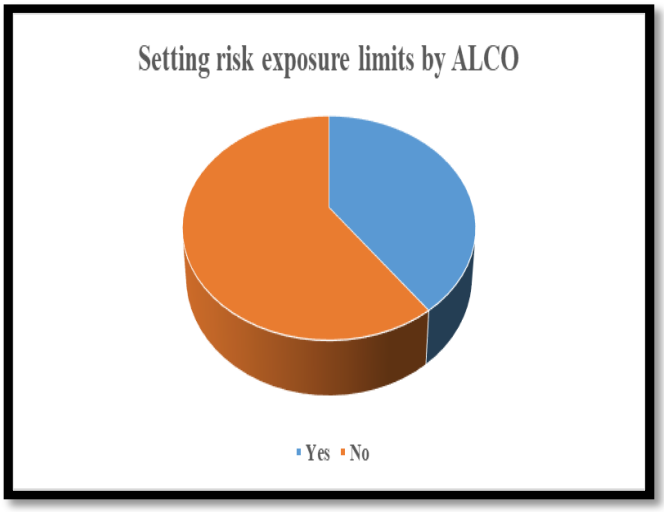
Section IV of the survey deals with the ALCO committee and its functional scope, including its ability to set risk exposure limits and metrics used to quantify risk. It also deals with the reports provided to the ALCO by different departments at the bank and how frequently these are reviewed. The pilot study respondents indicated that the functional scope of the ALCO includes liquidity risk, interest rate risk, exchange rate risk, and market risk (100% of the respondents). Some of the respondents (60%) indicated that credit risk is within the functional scope of the ALCO, whilst none of the respondents suggested that operational risk is within the functional scope of the ALCO. Moreover, all of the respondents indicated that the ALCO committee meets on a monthly basis. Furthermore, the results for the inputs provided to ALCO by various departments indicate that they focus mainly on the liquidity risk levels at the bank, overall bank performance, interest rate forecasts, deposit concentrations and costs of funding reports. Furthermore, the results indicate that all of the pilot study respondents (100%) suggested that their ALCO is not responsible for setting risk metrics but responsible for setting risk exposure limits (40% of the respondents). The ALCO report (output) is reviewed by 60% of the commercial banks on a monthly basis, while the remainder of the respondents (40%) indicated that the ALCO report is reviewed quarterly. In addition, the results indicated that it is reviewed by the board of directors (40%), the CEO and the supervisory authorities (60%), and by other departments (40%), as shown in Figure 20.

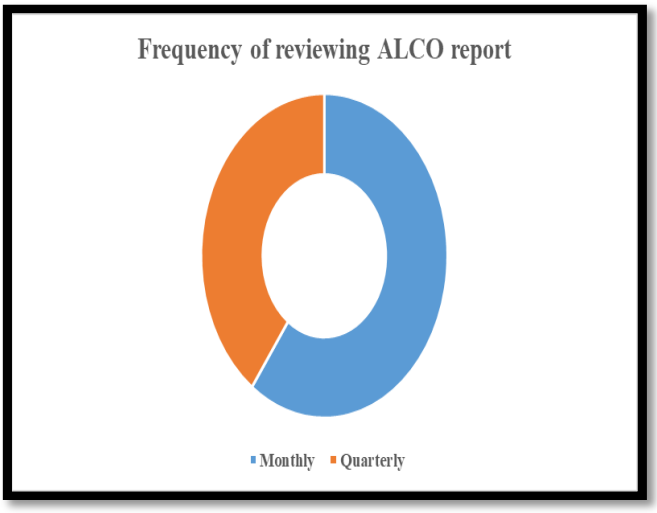
Figure 20: Asset Liability Committee Functional Scope and Reports









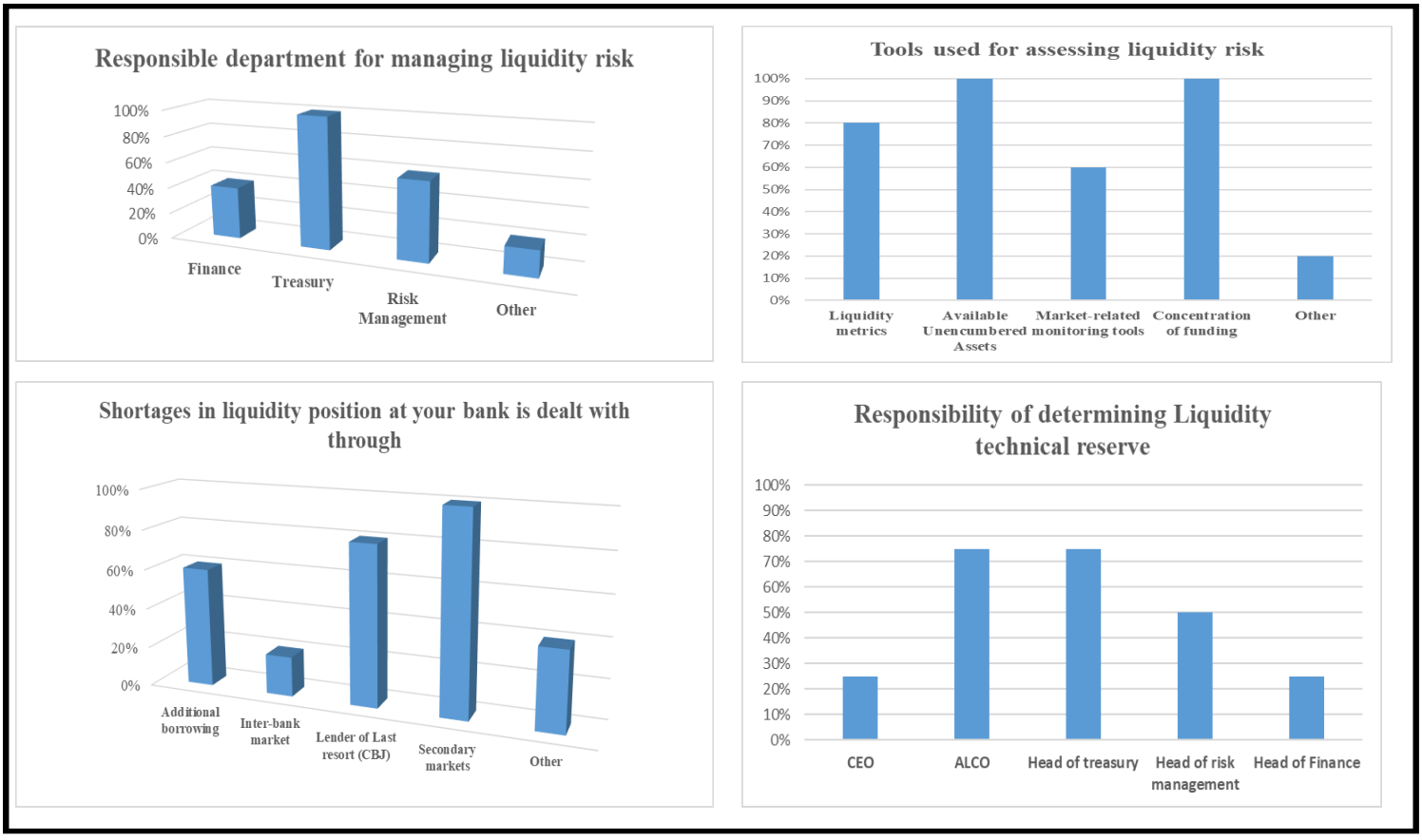


Source: Pilot study results

3.6.4 Liquidity risk

The pilot study respondents indicated that liquidity risk is managed by multiple departments at commercial banks, mainly the treasury department (100%) and the risk management department (60%). Moreover, the respondents indicated that they use various methods to assess the magnitude of liquidity risk through the availability of unencumbered assets (100%), the concentration of funding (100%), liquidity metrics (80%), and market-related monitoring tools (60%). They deal with liquidity shortages mainly through the lender of last resort (80%), using secondary markets (100%) or additional borrowing (60%). Furthermore, they indicate that the head of treasury and ALCO are responsible for determining their bank's liquidity technical reserves (60%), as shown in Figure 21.

Figure 21 : Managing Liquidity Risk

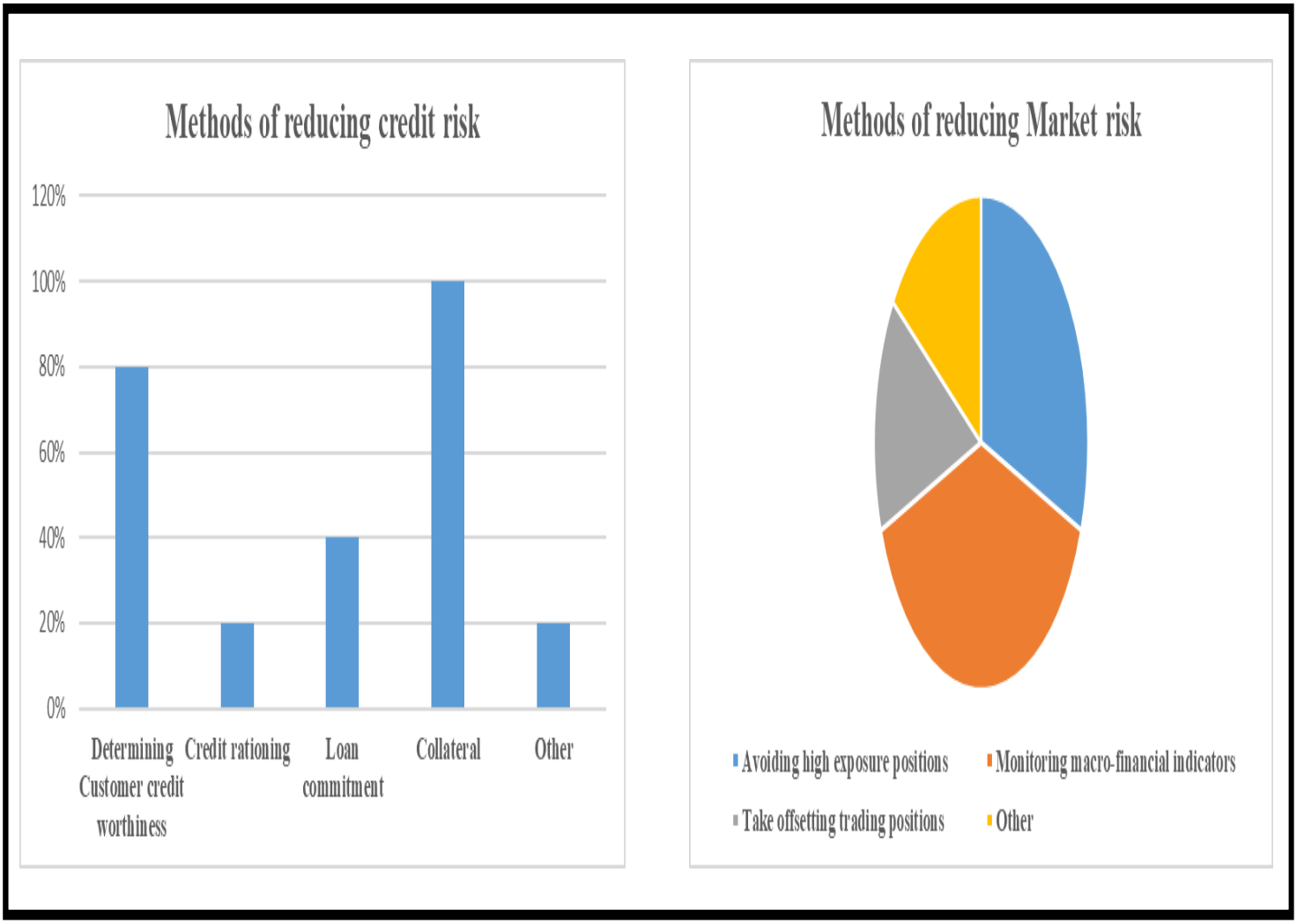


Source: Pilot study results

3.6.5 Interest Rate Risk

Most respondents (80%) indicated that they rely on various techniques to manage interest rate risk such as maturity ladders and gap analysis. Furthermore, they rely on various methods to reduce interest rate risk such as maturity matching loans and deposits and gap analysis (80%) and through floating rate loans (60%), as shown in Figure 22.

Figure 22: Managing Interest Rate Risk



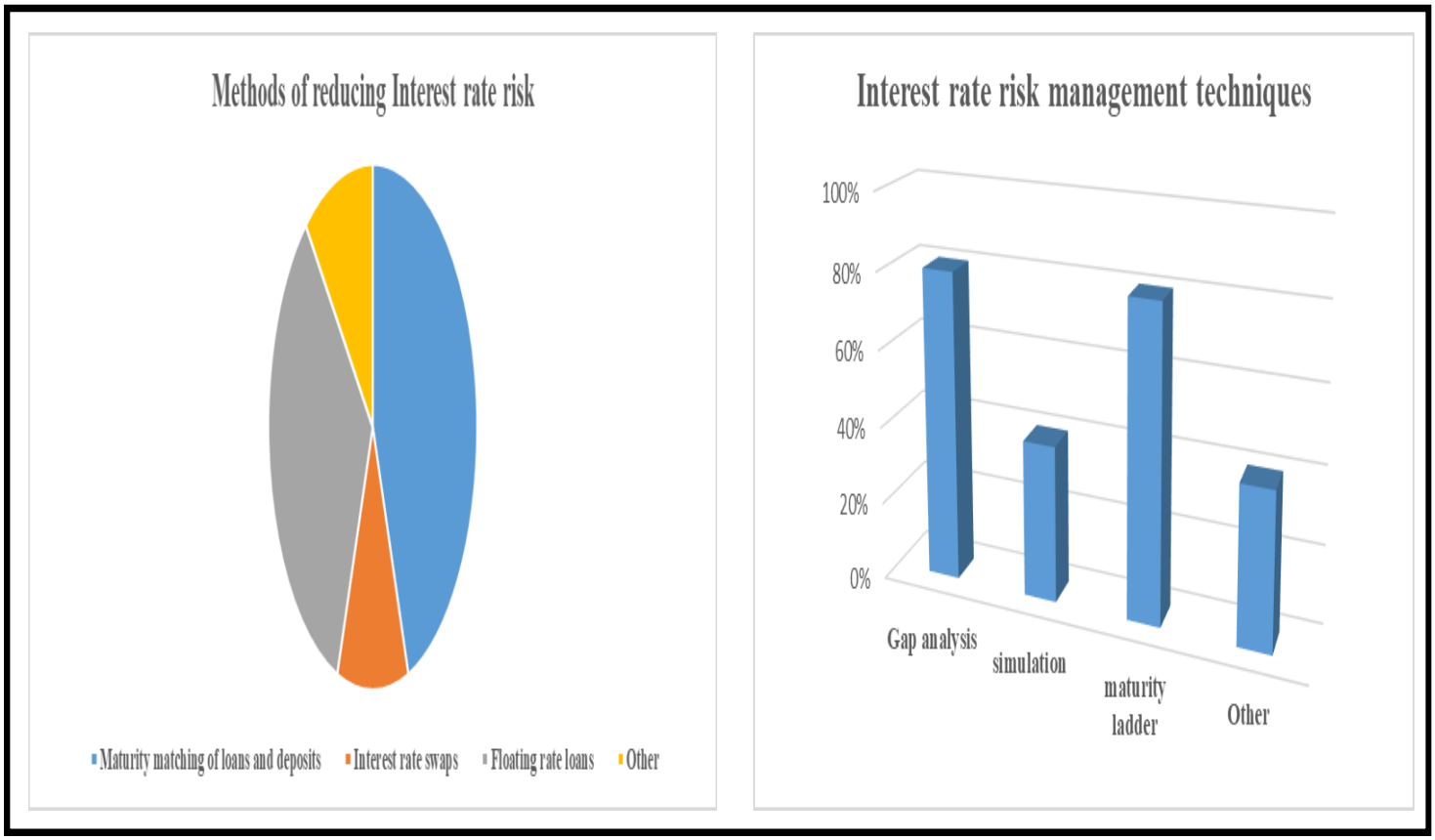
Source: Pilot study results

3.6.6 Credit and Market Risks

The respondents indicated that they rely on various methods to reduce credit risk and market risk. All of the pilot study sample indicated that they mainly use collateral (100%), determining

customer credit worthiness (80%), and loan commitment (40%) to mitigate or reduce credit risk. Furthermore, the pilot study relied on monitoring macro-financial indicators (100%) ,while (80%) try to avoid high exposure (80%) to mitigate market risk exposure, as shown in Figure 23.

Figure 23: Methods of Reducing Credit Risk and Market Risk

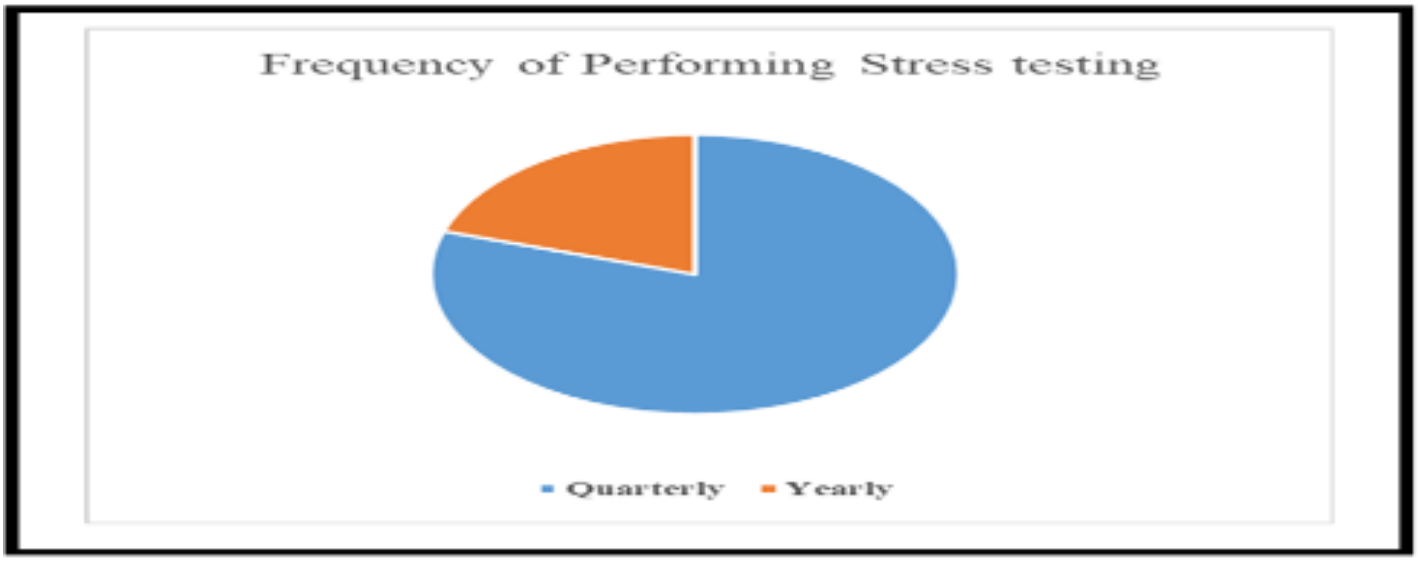


Source: Pilot study results

3.6.7 Contingency funding plan and stress testing

The pilot study respondents – the five banks – indicated that they have a contingency funding plan (CFP) and that they review it on a yearly basis. Furthermore, they indicated that they perform stress-testing scenarios on a regular basis. Around 80% of the respondents review it on a quarterly basis, while the rest (20%) review it each year.

Figure 24: Frequency of performing stress testing

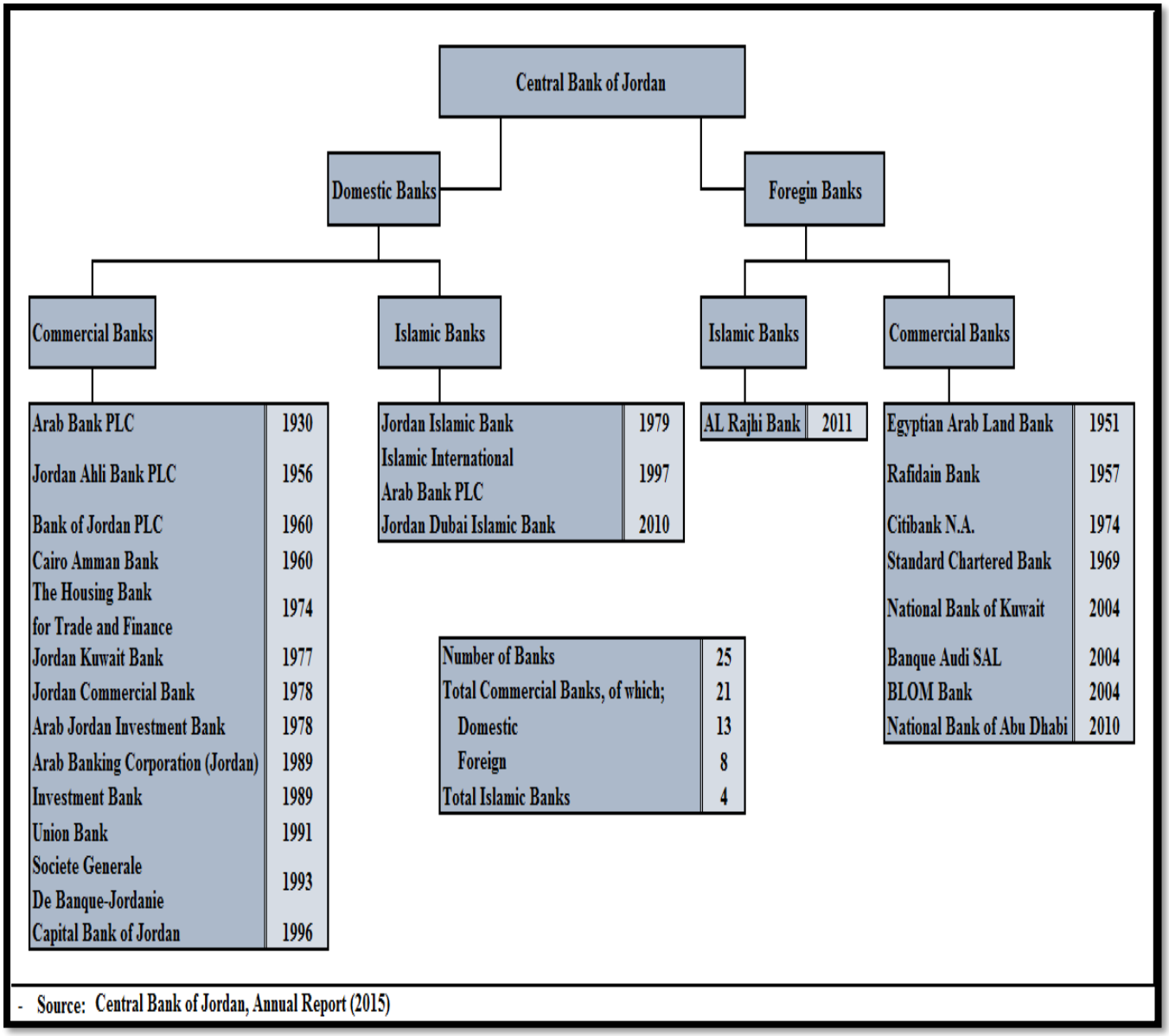


Source: Pilot study results

3.7 Questionnaire Results and Discussion

As mentioned in the previous section, the questionnaire survey was conducted between November 2017 and February 2018. The questionnaires were distributed to 21 respondents in Jordan. The final sample comprised 20 surveys with a final response rate of 95.2%. One of the banks was not responsive to the survey due to the fact that it does not operate in Jordan as a regular bank but only focuses on extending credit to Jordanian and Iraqi firms that operate in the import-export business between both countries. The sample represented all the commercial banks in Jordan, including domestic and foreign banks. The data were collected from the survey and were coded according to the context of the answers of the open-ended questions in the survey. The SPSS programme software was used to get the necessary results, which could help in describing the current situation of the ALM process at Jordanian banks. Figure 25 illustrates the banking system in Jordan.

Figure 25: The Banking system in Jordan (End of 2015)



Describing the current ALM framework in Jordan through a survey questionnaire mainly depended on the robustness of the methodology used for designing the questionnaire and putting in place a strategy for fieldwork in order to get more subjective and reliable results that could be used for laying the foundation to develop a suitable ALM framework strategy for Jordanian banks, which operate in a highly volatile region. The design of the survey has taken into consideration many aspects discussed above in order to ensure the success of the survey when carried out.

Table 4: Survey Questionnaire Summary

Item	Description
Survey aim	Describing the status of ALM process and ALCO at Jordanian commercial bank with a special focus on liquidity risk management.
Survey questionnaire type	Quantitative
Sampling methodology	Non-probability sampling
Sample	21 commercial banks
Desired completion time	Less than 30 minutes
Starting date	2017/2018
Period needed for survey completion	3 months

The primary elements of the questionnaire are the organisational structure, asset liability management, asset liability management committee, liquidity risk, interest rate risk, credit risk, market risk, contingency funding plans (CFP)and stress testing.

3.7.1 Demographics

This part presents the demographic information of the respondents' gender, age, educational level, working experience and position. Table 5 illustrates the demographic characteristics of the respondents.

Table 5: Demographic characteristics of study respondents

Item	Frequency	Percent	Cumulative%
Gender			
Male	10	50	50
Female	10	50	100
Age			
25-40	15	75	65
41-54	5	25	100
Educational Level			
Bachelor Degree	13	65	65
Post Graduate Degree	7	35	100

Working Experience			
5-10 Years	3	15	15
10-15 years	5	25	40
More than 15 years	12	60	100
The Position of the respondent			
Manager	18	90	90
Manager Assistant	2	10	100

The table illustrates the demographic characteristics of the study respondents at Jordanian commercial banks during the period of conducting the survey (November 2017 until February 2018).

The table shows that the sample consists of ten males (50%) and ten females (50%). Some 15 participants are between 25-40 years old (75%) while the rest of the participants are between 41-54 years old (25%). For the educational level of the respondents, most (65%) hold a bachelor's degree while the rest had a postgraduate degree (35%). Most of the respondents (60%) had more than fifteen years' experience, while fewer (25%) had experience ranging from ten to fifteen years. The rest (15%) had five to ten years' experience. The majority of the respondents had a manager position 90% while the rest were assistant managers. The results illustrate that the respondents have good experience in their field and high educational levels. The majority of the respondents also have more than fifteen years' experience in the banking industry, with most of the respondents holding high-level management positions, which will help us to get good feedback.

3.7.2 Organisational Structure

This part presents the organisational structure of ALM and ALCO, the departments responsible for managing ALM, and the positions that represent the asset liability committee in Jordanian commercial banks. Table 6 illustrates the organisational structure of ALM and ALCO.

Table 6: The organisational structure of ALM and ALCO

Item	Frequency	Percent	Cumulative %
Departments responsible for managing assets and liabilities			
Treasury Department	17	85	85
Finance Department	2	10	95
Risk Management Department	1	5	100
Existence of ALCO			
Yes	20	100	100
Department Represented in ALCO			
Head of Treasury	20	100	-----
CEO	19	95	-----
Head of Corporate Banking	18	90	-----
Head of Risk Management	18	90	-----
Head of Finance	18	90	-----
Head of Retail Banking	15	75	-----
Head of SME banking	10	50	-----
Other	4	20	-----
Head of Compliance Department	1	5	-----
Head of Internal Audit Department	1	5	-----

The table shows the organisational structure of ALM and ALCO at Jordanian commercial banks during the survey period (November 2017 until February 2018).

The organisational structure of the respondents in the study reveals that the treasury department bears the main responsibility for managing the banks' balance sheet at 17 banks (85%), whereas two banks (10%) indicated that the finance department is responsible for managing the banks' assets and liabilities. One bank (5%) indicated that the risk management department is responsible for managing the bank's assets and liabilities. In addition, all twenty banks (100%) showed that they have an ALCO in their organisational structure.

Furthermore, the results indicate that the head of treasury (100%) and CEO (95%), and (90%) heads of corporate banking, risk management and finance are part of the asset liability committee in Jordanian commercial banks. Also, 75% of the banks indicate that the head of retail banking is part of the ALCO; 50% include the head of SME lending. One bank indicated that the head of internal audit and head of compliance are also part of the ALCO. In addition, four banks indicated the existence of other members in the committee such as the head of credit, central operation, deputy CEO, credit risk officer, chief risk officer, treasury risk officer, and a deputy of general internal audit. The organisational structure of ALM at Jordanian commercial banks relies on the treasury department to manage the asset and liability sides. This is in line with the literature that one of the treasury department's functions is managing assets and liabilities as well as reporting to the ALCO. They can also manage the A/L sides in a separate unit of the treasury desk depending on the size of the bank, the variegation in its products and services, and its organisational structure (Bessis, 2015; Choudhry, 2011). Furthermore, the ALCO members at Jordanian commercial banks represent most banking activities, which is in line with the optimal ALCO members structure in the banking industry: ALCO members should include senior business line managers representing all of the bank's business activities and processes (Greuning & Bratanovic, 2009).

3.7.3 Asset Lability Management (ALM)

Balancing risks and profitability in the banking industry are a crucial part of bank decision-making processes. The inability to control surrounding environmental factors and their impact on business lines has compelled banking institutions to set up strategies and policies to mitigate against the impact of these shocks and benefit from existing opportunities. Thus, the main role of ALM is to provide metrics for various types of risk exposure while maximising a bank's risk-return profile (Choudhry, 2011). Section III will presents the aims of ALM process and

the main risks that are important to ALM. It will also set out the topics and tools covered by ALM policies and the frequency at which ALM strategies are assessed as well as other elements of ALM and its dependency on overall bank strategy. Table 7 presents the aims of ALM processes within Jordanian commercial banks:

Table 7: Aims of ALM processes

Item	Frequency	percent	Cumulative%
Existence of ALM process			
Yes	20	100	100
Aim of ALM process			
Managing risk exposures	14	70	----
Asset and liability mismatches	13	65	----
Pricing interest rate	4	20	----
Liquidity stress testing	3	15	----
Complying with CBJ rules and ratios	3	15	----
Quality and concentration of asset and liabilities	1	5	----
Other	4	20	----

All Jordanian commercial banks (100%) indicated that an ALM process exists within their organisations, and the aim of ALM in 14 Jordanian commercial banks was stated as managing risk exposures (70%). In addition, 13 banks indicated examining asset and liability mismatches (65%) as an aim of ALM. Four banks (20%) indicated that pricing interest rate products was another function of ALM in Jordanian commercial banks, and three banks (15%) indicated liquidity stress-testing and ensuring compliance with CBJ rules and ratios as an aim of ALM. While, four banks (20%) present other aims in general, such as concentration of deposits and

funding, managing the best investments for assets and liabilities, managing costs and profits) as aims of ALM in Jordanian commercial banks. However, one bank's (5%) respondents indicated assessing the quality and concentration of assets and liabilities as one of the important functions of ALM. Table 8 presents the risks considered important to the ALM process in Jordanian commercial banks:

Table 8: Risk importance in ALM process

Item	Frequency	percent	Cumulative%
Highest risk exposure			
Liquidity risk	15	75	75
Interest rate risk	2	10	85
Credit risk	3	15	100
Second risk exposure			
Liquidity risk	4	20	20
Interest rate risk	14	70	90
Credit risk	2	10	100
Third risk exposure			
Market risk	8	40	40
Credit risk	4	20	60
Foreign exchange risk	3	15	75
Operational risk	2	10	85
Interest rate risk	2	10	95
Liquidity risk	1	5	100

Fifteen of Jordan's commercial banks (75%) indicated that the most important function of ALM is to manage liquidity risk as the most important risk. Fourteen of Jordan's commercial banks (70%) stated that interest rate risk as the second most important risk exposure monitored

by ALM. Seven banks (40%) indicated market risk as the third most important risk monitored by ALM in Jordanian commercial banks. Table 9 presents the main topics and tools used in the ALM process and the frequency of ALM assessment within Jordanian commercial banks.

Table 9: ALM process main topics, management tools, and review

Item	Frequency	Percent	Cumulative %
Topics covered by ALM policies			
Investment and hedging strategies	16	80	-----
Methodology for measurement of risks	14	70	-----
New product approval	10	50	-----
Limit setting and control	12	60	-----
Others	3	15	-----
Management tools used for ALM			
Cash flow matching	16	80	-----
Asset/liability projections	15	75	-----
Duration matching	11	55	-----
Description	3	15	-----
Other	3	15	-----
Efficient frontier analysis	1	5	-----
Frequency of ALM assessment strategy			
Monthly	8	40	40
Yearly	5	25	65
Daily	2	10	75
Occasionally	2	10	85
Quarterly	2	10	95
Other	1	5	100

As for the topics covered in the ALM process, the results indicate that the ALM processes of 16 banks (80%) cover investment and hedging strategies, while 14 banks (70%) pointed out that their ALM processes examine methodologies for measuring risks. Furthermore, twelve banks (60%) indicated that ALM covered limit setting and control, and ten banks (50%) presented a new product approval covered this area in ALM policies at Jordanian commercial banks. Three banks (15%) mentioned that ALM covers compliance with the regulator's set ratio, funding policy and contingency plans, as well as the internal and external pricing of all balance-sheet products.

As for the management tools used in ALM processes at Jordanian commercial banks, 16 banks (80%) indicated that they use cash flow matching in ALM while 15 banks (75%) used asset liability projections. Furthermore, 11 banks (55%) used duration matching in their ALM. Only three banks (15%) used description and other tools such as sensitivity analysis, the CAMEL model and behavioural profiling (15%). Lastly, one bank used efficient frontier analysis.

Eight of the respondent banks (40%) showed that they assess their ALM strategy on a monthly basis; five banks (25%) on a yearly basis; and six banks divided between quarterly, occasionally and daily. One foreigner bank responded that the frequency of their ALM assessment was no decided within their Jordan branches but managed by outside head office.

Table 10: The main elements of ALM and its dependency on bank overall strategy

	Item	Minimum	Maximum	Mean	S.D
1	The ALM strategy is set by ALCO.	4.00	5.00	4.55	0.51
2	ALM strategy is set in accordance with the overall strategic objectives of the bank and disseminated throughout the bank.	2.00	5.00	4.25	0.79
3	ALM strategy is consistent with the operational objectives and takes into account the balance sheet structure, and the status of different product lines.	3.00	5.00	4.35	0.59
4	ALM is a dynamic process based on analysing, assessing, and reviewing the effectiveness of the set strategies based on reports and findings.	3.00	5.00	4.45	0.60
5	The ALM strategy considers potential impacts on non-quantifiable risks.	3.00	5.00	3.85	0.59
6	Risk exposure limits are set based on the overall strategy of the bank in a way that takes product line levels into consideration.	3.00	5.00	4.00	0.56
7	The ALM process incorporates operational, credit and market risks, as well as formulates risk exposure strategies and sets limits.	3.00	5.00	4.00	0.65
	Average			4.20	

Table 10 shows the response results of seven statements regarding the main elements of ALM and it dependency on banks' overall strategy. The average mean of the responses to these statements was 4.2 on a five-point Likert scale. The respondents' answers to the seven statements indicated that ALM strategy was consistent with banks' overall strategies within Jordanian commercial banks. However, there was no big difference between the highest and lowest means of the seven statements, as Table 11 shows. The highest mean (4.55) was that of the first statement, in which respondents viewed ALM strategy as being set by ALCO in Jordanian commercial banks. The lowest mean (3.85) was for statement five concerning ALM's consideration of potential impacts on non-quantifiable risks. The Jordanian commercial banks strongly agreed that banks' ALM strategy is consistent with their operational objectives

and take into account balance sheet structures and the status of different product lines. Furthermore, the ALM process is a dynamic process based on analysing, assessing, and reviewing the effectiveness of set strategies based on reports and findings. However, they agreed that the ALM process is incorporated into banks' overall strategy and that risk exposure limits are set based on the overall strategy of the bank in a way that takes into consideration product line levels. In addition, they agreed that ALM takes into account incorporating operational, credit and market risks while formulating risk exposure strategies and setting limits.

All of the Jordanian commercial banks have ALM processes in reaction to the multitude risks and challenges they are facing or may face in future. The main aim of ALM at Jordanian commercial banks is to manage risk exposure. In this case, it is in line with the main role of ALM in providing metrics for various types of risk exposure and to provide a hedging reaction against risks to financial institutions (Choudhry, 2011; Zawalinska, 1999). In addition, mismatches between assets and liabilities receive adequate attention from Jordanian commercial banks in the ALM process. Mismatch between the asset and liability sides is part of the concept of ALM in the early stages; banking management was based on gap analysis to analyse mismatching, which then developed into duration gap models (Shrestha, 2015).

The Jordanian commercial banks focus on their liquidity risk exposure as they consider liquidity risk to be the most important risk to address. The banks actively manage their liquidity risk exposure within their business lines and take into account the regulatory limitations to the transferability of liquidity (BIS, 2008). Other researchers found credit risk to be the most common risk faced by banks. Mokni et al. (2015) found credit risk to be the most common risk faced by both types of bank (conventional and Islamic) in the MENA area, while liquidity risk

was the second most crucial risk. Alam and Masukujjaman (2011) in particular found credit risk to be the most important risk facing five banks in Bangladesh followed by operational risk and market risk.

The main goal for banks is profit maximisation. While they achieve this through granting loans, they try to minimize the risks to their operations as much as possible. It is often a bank's treasury department that implements ALM as they appear to work on 'integrated treasury functions' whereby they make profit while managing hedging (ADB, 2009). In addition, Jordanian commercial banks shown for setup methodologies for measuring risks, this preserve the viability of the bank but they need detailed reports that reflect the bank activities and the market conditions (Joshi & Sontakay, 2017).

The topics covered in Jordanian banks' policies are in line with the sound management framework published by the Asian Infrastructure Investment Bank, which stresses the need for an effective ALM policy. This requires an effective system for managing liquidity risk and insuring appropriate limits of risk taking (Asian Infrastructure Investment Bank's, 2017). In addition, they indicated the approval of new products covered as result of the emergence of new financial products and service over the past two decades (Tektas, 2005). Jordanian commercial banks use cash flow matching as a major tool in their ALM in order to preserve the solvency of their bank and their ability to meet their financial obligations (Vij, 2005). Most of the Jordanian commercial banks assess their ALM strategies monthly which is good sign and update their strategies in line with incoming development, events and actions.

In addition, they show that ALM strategy setting by ALCO is consistent with their main functions (Choudhry, 2011). Furthermore, the ALM strategy at Jordanian commercial banks is set with the overall strategy and operational objectives and based on balance sheet structure

and the status of different product lines. Risk exposure limits are set in line with the bank's overall strategy and take into consideration product business levels. ALM processes incorporate the operational, credit and market risks to formulate risks exposure strategies and limits.

Indeed, the effectiveness of the ALM framework is considered one of the main factors that contributes to maximising profitability while mitigating the effects of risk factors (Bessis, 2011). The ALM framework should be compatible with the bank's overall strategy as well as the individual business lines' strategy planning, coordinating, and controlling the assets and liabilities (Charumathi, 2008). In addition, ALM strategies and policies should be reviewed periodically by comparing actual performance with projections (BIS, 2008; Vento & La Ganga, 2009; Drehmann, 2013). The results came in line with the resercher expectations in the hypothesis section as Jordanian commercial banks have an effective ALM framework

3.7.4 The Asset and Liability Committee (ALCO)

Section IV of the survey deals with the asset and liability committee (ALCO) and its functional scope, including its ability to set risk exposure limits and metrics used to quantify risk. It also deals with the reports provided to the ALCO by different departments at the bank, their report and the frequency of reviewing it. Table 11 shows the functional scopes that ALCO consider and the frequency of ALCO meetings as well as the reports provided to ALCO from various departments and units expressing the bank's activities and business lines.

Table 11: The functional scope of ALCO, frequency of its meetings and its inputs

Item	Frequency	Percent	Cumulative %
The functional scope of risks that ALCO considers			
Liquidity risk	20	100	-----
Interest rate risk	19	95	-----
Market risk	17	85	-----
Exchange rate risk	16	80	-----
Credit risk	14	70	-----
Operational risk	3	15	-----
Others	1	5	-----
Frequency of ALCO meetings			
Monthly	17	85	-----
Quarterly	2	10	-----
Reports provided to ALCO by other departments			
Liquidity reports and stress testing	15	75	-----
Balance sheet and income statement bank performance	14	70	-----
Deposit concentration and big deposit report	12	60	-----
Cost of funding report	9	45	-----
Market report	7	35	-----
Interest rate risk report and forecasting	6	30	-----
Regulatory compliance report	6	30	-----
Credit report and forecast	5	25	-----
Macroeconomic report	3	15	-----
Treasury report	3	15	-----
Bank investment report	3	15	-----

Business line report	3	15	-----
Early warning indicators	1	5	-----
Repricing gap	1	5	-----
Profitability report	1	5	-----
A&L by currencies	1	5	-----

All of the respondents from the commercial banks in Jordan (100%) indicated that liquidity risk is one of the functional scopes of ALCO, in line with Bessis (2015). This shows that one of the core tasks of ALCO is to manage liquidity risk, which arises from volume and maturity mismatches of assets and liabilities. Table 12 shows nineteen banks in Jordan (95%) who consider interest rate risk to be a functional scope of ALCO; seventeen banks (85%) who consider market risk; sixteen banks (80%) who consider exchange rate risk; and 14 banks (70%) for credit risks. Three banks (15%) indicate operational risk. The results shows that the most Jordanian commercial banks see the main functional scopes of ALCO as being liquidity risk, interest rate risk and market risk.

The ALCO in Jordanian commercial banks tend to meet mostly on a monthly basis, as indicated in Table 11. Seventeen banks (85%) meet on a monthly basis, while two banks (10%) meet on a quarterly basis. One banks does not specify the frequency of its ALCO meetings. The majority of Jordanian commercial banks therefore meet monthly for ALCO. The frequency of the ALCO meetings depends on the nature of each bank and its activities, but is usually monthly (Choudhry, 2011). The ALCO members meet on regular basis to discuss recent developments in their supported business lines and changes in the surrounding environment (Choudhry, 2018). In those markets that are more volatile and where banks' activities are more exposed to risk, the ALCO should meet every week if not twice (Dedu & Vasilache, 2008). This indicates

that the Jordanian market seems to be less volatile as the ALCO meets on a monthly basis or/and the activities of the banks are less exposed to risks and less complicated.

The ability of the ALCO to monitor and measure risks determines the viability of the bank. Thus, they need detailed reports that reflect the bank's activities and the market conditions (Joshi & Sontakay, 2017). Table 11 shows the reports that are provided to the ALCO from the various departments/units in the banks. The liquidity and stress testing reports are the main ones provided to the ALCO in fifteen banks (75%). Bank performance reports with balance sheet and income statements are provided to ALCO in fourteen banks (70%) while deposit concentration and big deposit reports are provided in twelves banks (60%). The cost of funding report is provided in nine banks (45%) while seven banks (35%) provide market reports and six (30%) provide interest rate risk reports and forecasting and regulatory compliance reports. Only three banks (15%) provide other reports such as macroeconomic reports, treasury reports, bank investment reports and business line reports. Finally, one bank (5%) provides reports of early warning indicators, repricing gaps, profitability reports, and assets and liabilities by currencies to its ALCO. The majority of Jordanian commercial banks provide reports related to their liquidity position and balance sheet, including their deposit concentration and cost of funding, while fewer than four banks only provide reports regarding the business lines which express the banks' activities on a business level. Less than half of the bank respondents (30%) provide interest rate risk reports to ALCO. The overall reports show the components of banks' assets and liabilities, take into account macroeconomic factors and include balance sheet management and business line level reports. These reports should contain scenario planning under micro and macro level market conditions and the latest short-term projections (Choudhry, 2012).

Table 12 shows the responsibility of ALCO at Jordanian commercial banks in setting risk metrics and risk exposure limits. In addition, specified risks metrics are used, as well as the responsible for reviewing ALCO report and frequency of reviewing.

Table 12: The ALCO report and its role in setting risk metrics and exposures

Item	Frequency	Percent	Cumulative %
Setting risk metrics by ALCO			
Yes	10	50	50
No	10	50	100
Risk metrics by ALCO for liquidity risk			
Legal Liquidity Ratio	5	-----	-----
LTD	2	-----	-----
Concentration	1	-----	-----
Other	4	-----	-----
Risk metrics by ALCO for Interest rate risk			
IR GAP	4	-----	-----
DV01	1	-----	-----
Equity to income	1	-----	-----
Other	3	-----	-----
Risk metrics by ALCO for Credit risk			
NPL	1	-----	-----
Concentration	2	-----	-----
Other	3	-----	-----
Risk metrics by ALCO for Market risk			
FX Position	3	-----	-----
VaR	1	-----	-----
Other	2	-----	-----

Setting risk exposure limits by ALCO			
Yes	10	50	50
No	10	50	100
ALCO report is reviewed by			
CEO	14	70	-----
Board of directors	10	50	-----
Central bank	9	45	-----
Others	7	35	-----
Shareholders	1	5	-----
Frequency of reviewing ALCO report			
Monthly	15	75	75
Quarterly	5	25	100

The results in Table 12 indicates that the ALCO in ten of the respondent banks (50%) is not responsible for setting risks metrics. In these ten banks, the legal liquidity ratio is used as well as the loan to deposit (LTD) ratio as major risk metrics to gauge liquidity risks. In addition, the ALCO uses interest rate gap and dollar duration (DV01) as metrics of interest rate risk, while using concentration and non-performing loans as risk metrics for credit risk. For market risk, they use FX position and value at risk (VaR). Some 50% of the banks stated that their ALCO is responsible for setting risk limits. Table 12 also shows the role of ALCO in setting risk metrics and limits. Some 50% of the respondents stated that this is not the responsibility of their ALCO. Two banks mentioned that the ALCO is not responsible for setting risk metrics but is responsible for setting risk limits. Two other banks stated that the ALCO is responsible for setting risk metrics while they are not responsible for setting risks limits. Eight banks (40%) stated that the ALCO is responsible for setting risks metrics and limits together, while another eight banks stated that the ALCO is not responsible for setting risk metrics or limits.

The ALCO report (output) is reviewed by the CEO in fourteen banks (70%) and reviewed by the board of directors in ten banks (50%). The Jordanian central bank reviewed the output reports of nine banks' ALCO (45%) and one bank stated that the report is reviewed by shareholders. In seven banks (35%), the reports were reviewed by the group ALCO, external auditors, board risk committee, CFO and/or internal editors. The ALCO report (output) is reviewed on a monthly basis in fifteen banks (75%), while the remainder (25%) review the ALCO report on a quarterly basis.

Table 13 summarises the responses about ALCO report input and output. The mean of the responses to the six statements is 4.05 for the five-point Likert scale. The highest mean (4.50) was that of the first statement, in which respondents viewed liquidity reports provided to ALCO as containing risk exposures and funding liquidity plans. The lowest mean (3.55) was for statement six concerning the central bank effectiveness of supervises ALCO decisions in commercial banks in Jordan. The results shown the respondents strongly agree with the statement that the ALCO report focuses on the overall performance of the bank as well as business levels and that it must focus on proposing strategies that could enhance future performance. Furthermore, they strongly agree that periodic reviews are conducted to assess the performance of the strategies adopted by commercial banks, but they were neutral about the board responsibility in adopting the strategy proposed by the ALCO report and the effectiveness of central bank in supervising ALCO decisions.

Table 13: ALCO inputs and outputs

Item	Minimum	Maximum	Mean	S.D
Liquidity reports provided to ALCO contain risk exposures, funding liquidity plans, and other.	4.00	5.00	4.50	0.51
ALCO report must focus on proposing strategies that could enhance future performance.	3.00	5.00	4.15	0.59
ALCO report focuses on the overall performance of the bank and business level.	3.00	5.00	4.20	0.62
The Board of Directors are responsible for adopting the proposed strategies in the ALCO report.	2.00	5.00	3.80	1.06
A periodic review is conducted for reviewing the performance of adopted strategies.	3.00	5.00	4.10	0.55
The central bank effectively supervises ALCO decisions at your bank.	2.00	5.00	3.55	0.76
Average			4.05	

Every ALCO at Jordanian commercial banks monitors liquidity risks, in line with Bessis (2015). This risk arises from volume and maturity mismatches of assets and liabilities. In addition, the majority of ALCOs at Jordanian commercial banks meet on a monthly basis in line with the literature that should meet on a regular basis with the asset and liability committee meeting each month (Choudhry, 2011). Furthermore, the inputs for ALCO from various departments of the bank focus on liquidity management, balance sheet performance, deposit concentration, and cost of funding. While a few banks (15%) of the respondents mentioned providing products activities in every business line reports, usually the features of the treasury reports that are provided to ALCO including financial and business line risk management (Bessis, 2015). The business line report by product can show the portion of total assets

represented by each business line and which line has the greatest forward funding requirements (Choudhry, 2011).

Some 15% of the Jordanian commercial banks stated that the ALCO is not responsible for setting risk metrics and risk exposure limits. In addition, they did not mention a specific unit that deals with these duties and presented as an ALCO member such as A/L unit when the study asked before for ALCO members. Furthermore, the main risk metrics for liquidity risks in Jordanian commercial banks are the legal liquidity ratio and loan to deposit ratio, concentrations used as risk metrics in most of the banks that pointed for the ALCO is responsible for setting risks metrics, every metrics of them cover specific issue, to be sufficient should be used in conjunction with the other metrics such as LTD ratios (Choudhry, 2011). Furthermore, they use the IR Gap as a metric to measure interest rate risk and therefore should monitor market and interest rate forecast to increase the activation of these metrics (Vij, 2005). Most respondents stated that the CEO and board of directors were responsible for reviewing the ALCO report on a monthly basis (ADB, 2009). ALCO reports in Jordanian commercial banks include risk exposures and pay attention to various types of risks – liquidity risks in particular – as their reports include funding liquidity plans. In addition, the central bank of Jordan effectively supervises ALCO decisions at Jordanian commercial banks through its legislative powers to supervise the banking sector (IFC, 2008). These results are in line with the researcher expectations in the hypothesis section as ALCO is effectively involved in implementing ALM strategies and policies in Jordanian commercial banks.

3.7.5 Liquidity risk

Liquidity risk is considered the top priority of Jordanian commercial banks with 75% of the Jordanian commercial banks in the study stating that the main purpose of asset and liability

management is to manage liquidity risk. Table 14 shows the respondents' answers related to managing, quantifying and monitoring liquidity risks in Jordanian commercial banks as well as the measures used to set liquidity risk limits.

Table 14: Managing and monitoring liquidity risk

Item	Frequency	Percent	Cumulative %
Department responsible for managing liquidity risk			
Treasury Dep.	16	80	-----
Risk Management Dep.	10	50	-----
Finance Dep.	7	35	-----
Other	1	5	-----
Quantifying liquidity and funding liquidity risk			
Legal liquidity ratio	12	60	-----
Gap analysis	5	25	-----
Loan to deposit ratio (LTD)	5	25	-----
Liquidity ladders	4	20	-----
Stress test	4	20	
NPL	2	10	-----
Setting liquidity and funding liquidity risk limits			
Business model	8	40	-----
CBJ guidelines	8	40	-----
Risk appetite	5	25	-----
Liquidity risk management policy	3	15	-----
Assets and liabilities maturities	2	10	-----
Frequency of monitoring liquidity positions			
Daily	20	100	-----

As shown in Table 14, in 16 Jordanian commercial banks (80%) it is the treasury department that is responsible for managing liquidity risks. Other departments participate in managing liquidity risk in Jordanian commercial banks: ten banks (50%) listed their risk

management department; seven banks (35%) listed their finance department; and one bank (5%) listed the ALCO as being responsible for managing liquidity risk.

Twelve (60%) of Jordan's commercial banks rely mainly on legal liquidity ratios to quantify liquidity and funding liquidity risks. Five banks (25%) listed using the loan to deposit ratio (LTD) and gap analysis to quantify liquidity and funding liquidity risks. Four banks (20%) use the liquidity ladder and stress tests. While two banks (10%), indicate using non-performing loans as a measure to quantify liquidity risk and funding risks. Others measures such as financial resources concentration, contingency funding plan CFP were listed but do not appear to be widely used by Jordanian commercial banks.

Table 14 also showed eight Jordanian commercial banks (40%) setting their limits for liquidity risk through their business model and central bank of Jordan guidelines. In addition, risk appetite and liquidity risk management policy are used to set liquidity risk limits in five and three banks, respectively. Moreover, two banks (10%) set liquidity risks and funding risk limits through asset and liabilities maturities. Liquidity positions, such as intraday liquidity, should be managed by banks to meet payment and settlement obligations on a timely basis under both normal and stressed conditions (BIS, 2013). The Jordanian commercial banks indicated that they monitor their liquidity positions on daily basis, as shown in Table 14.

The Jordanian commercial banks indicated that they use various methods to assess/monitor the magnitude of liquidity risk, and that they deal with shortages in their liquidity position through multiple procedures. Table 15 presents the methods/tools and procedures used.

Table 15: Liquidity risk assessment and funding liquidity risk

Item	Frequency	Percent	Cumulative %
Tools used for assessing liquidity risk			
Contractual maturity mismatch	18	90	-----
Concentration of funding	16	80	-----
Liquidity metrics	13	65	-----
Market-related monitoring tools	9	45	-----
Available unencumbered assets	5	25	-----
Shortages in liquidity position at your bank is dealt with through			
Inter-bank market	16	80	-----
Additional borrowing	15	75	-----
Lender of last resort (CBJ)	12	60	-----
Secondary markets	10	50	-----
Other	3	15	-----
Capital is considered one of the means that can be used to correct/ mitigate liquidity risk exposure			
Yes	13	65	65
No	7	35	100
Funding liquidity is a type of risk that banks are exposed to			
Yes	20	100	100
Adopted measures to avoid the funding liquidity risk			
Monitoring liquidity ratios & limits	13	65	-----
CFP	5	25	-----
Diversifying Deposits	4	20	-----
Matching assets and liabilities	1	5	-----
Order of importance of funding liquidity risk forms			
Item	Most Important	Medium Important	Less Important
Margin funding risk	30%	20%	50%
Redemption risk	30%	60%	10%
Rollover risk	40%	20%	40%

Eighteen banks (90%) assess/monitor their liquidity risks through the contractual maturity mismatch tool; 16 (80%) use the concentration of funding indicator tool; 13 (65%) use liquidity

metrics; and nine (45%) use market-related monitoring tools. The available unencumbered assets indictor was used by five banks (25%), as shown in Table 15.

Sixteen Jordanian commercial banks (80%) dealt with their liquidity shortages mainly through the inter-bank market while 15 banks (75%) chose to borrow more to cover their liquidity shortages. Twelve banks (60%) used facilities from the central bank as the lender of last resort and ten banks (50%) used the secondary markets. The banks also indicated other tools such restrictions on loan portfolio growth and including highly liquid assets in portfolios that can be liquated easily in the markets.

From the results above, the researcher notice that the interbank market at Jordanian commercial banks is active through the dependency of 80% of the commercial banks on this market to cover and settle their liquidity position shortages that result from their central bank requirements or intraday activities. The central bank of Jordan tries to effect an undirected route in the interbank market through providing a weekly repo that might affect the volume and the rate of the interbank market. In addition, the study revealed that 13 banks – around 65% of the respondents – consider capital as one of the means that can be used to mitigate liquidity risk exposure. Furthermore, all of the commercial banks (100%) acknowledged that funding liquidity is a risk that commercial banks are exposed to. They rely mainly on monitoring their liquidity ratios and limits to avoid funding liquidity risk and contingency funding plans as well as diversifying their deposits and matching their assets and liabilities. The Jordanian commercial banks consider rollover risk to be the most important form of funding liquidity risk and redemption risk as the second most important risk that they face. They view margin funding risk as less significant. These results are shown in Table 15.

Eighteen (90%) of Jordan's commercial banks had a liquidity technical reserve buffer while the other two (10%) did not. This illustrates that they hold their mandatory reserve amount at the central bank without benefiting from the maintenance period set by the central bank instructions.

Table 16: Liquidity technical reserve buffers

Item	Frequency	Percent	Cumulative%
Existence of liquidity technical reserve buffers			
Yes	18	90	90
No	2	10	100
Determining liquidity technical reserve volume			
Stress testing	10	50	-----
Liquidity management polices	10	50	-----
Risk appetite	4	20	-----
CBJ regulations	2	10	-----
Responsibility of determining liquidity technical reserve			
Head of treasury	13	65	-----
Head of risk management	8	40	-----
ALCO	7	35	
Head of finance	5	25	-----
CEO	4	20	-----
Head of retail banking	2	10	-----
Other	2	10	-----
Head of corporate banking	1	5	-----

In addition, half of the Jordanian commercial banks (50%) determine the volume of their liquidity technical reserve through stress testing and liquidity management policies. Risks

appetite and central bank regulations determine the volume of the liquidity technical reserve buffer for four and two of study respondent banks (20%, 10%) respectively. The head of the treasury department mainly responsible for determining the liquidity technical reserve, as indicated by thirteen commercial banks (65%). The head of the risk management department is also responsible, as indicated by eight banks; while ALCO determines the technical reserve buffer in seven banks (35%) and the head of finance in five (25%). CEOs in Jordanian commercial banks and heads of retail banking had less of a role in determine liquidity technical reserves for Jordan's commercial banks, as indicated by only four banks (20%) for CEOs and two banks (10%) for heads of retail, as shown in Table 16.

Jordan's commercial banks consider liquidity risk the most important risk to manage. The questionnaire distributed for this study includes seven statements addressing liquidity risk management in Jordanian commercial banks. Table 17 provides information about the responses to these statements.

Table 17: Liquidity risk management

	Item	Minimum	Maximum	Mean	S.D
1	Liquidity risk management is consistent with the overall strategy of the bank.	4.00	5.00	4.40	0.50
2	Liquidity risk is set according to the institutional and department level.	3.00	5.00	4.10	0.64
3	Liquidity risk exposure limits are set while considering operational liquidity needs.	2.00	5.00	4.15	0.67
4	Implementation of Basel III enhances liquidity risk management.	4.00	5.00	4.30	0.47
5	Implementation of Basel III adds additional strains on banks' ability to make structural changes to their liquidity positions.	3.00	5.00	4.10	0.72
6	Contingent liquidity needs are taken into consideration while setting up liquidity risk exposures.	3.00	5.00	4.15	0.59
7	Financial derivatives are used as tools to manage liquidity risk.	2.00	5.00	3.75	0.79
	Average			4.13	

Most Jordanian commercial banks strongly agreed that liquidity risk management is consistent with the overall strategy of the bank and that the liquidity risk level is set according to institutional and department agreement while considering operational liquidity needs. In addition, most of the respondents strongly agreed that the implementation of Basel III would enhance liquidity risk management and put additional strain on banks' ability to make structural changes to their liquidity positions. Furthermore, they strongly agree that contingent liquidity needs are taken into consideration while setting up liquidity risk exposures. The Jordanian commercial banks they natural about using the financial derivatives as tools to manage liquidity risk. The highest value, 4.40, occurs on statement one, which states "Liquidity risk management is consistent with the overall strategy of the bank." This confirms that liquidity risk management in Jordanian commercial banks is in line with their overall strategy. While

the lowest value, 3.75 occurs on statement seven, which states, “Financial derivatives are used as tools to manage liquidity risk”. The responses provide an indication that Jordanian commercial banks do not use advanced tools to manage their liquidity risks.

Jordanian commercial banks manage liquidity risks through a participatory process among a number of departments – mainly the treasury and risk management departments. Therefore, the effect of the liquidity crunch that faced banks during the Global Financial Crisis reinforced the importance of liquidity management by treasury departments in particular in corporate treasury divisions or other departments (Choudhury, 2015). The Jordanian commercial banks apply multiple metrics and tools to quantify and mitigate liquidity risks. They mainly use the legal liquidity ratio alongside other risks metrics that can provide a wider view of liquidity risk exposure. In addition, the business model and risk appetite are mainly indicators used to set liquidity risk limit in line with the size and complexity of banks’ activities and business strategy (BIS, 2008). Furthermore, all of the Jordanian commercial banks monitor their liquidity positions on a daily basis to understand their liquidity needs and avoid liquidity risks that can arise from volume and maturity mismatches of assets and liabilities (Bessis, 2015).

The contractual maturity mismatch used in most Jordanian commercial banks to assess/monitor liquidity risks expresses the gap between inflows and outflows of liquidity arising from long-term illiquid assets and liquid liabilities, respectively (Adalsteinsson, 2014; Pohl, 2017). This indicates and guides banks towards the attitude in extending loans and accepted deposits over the maturity mismatch in any specific time band. In general, the more diversified a bank’s source of deposits (funding structure), the less likely they are to be withdrawn at the same time. Jordanian commercial banks focus also on concentration of funding to determine the probability of deposits being withdrawn at the same time. Most

Jordanian commercial banks address shortages in their liquidity positions through the interbank market and by using central bank facilities (Aspachs, et al., 2005; Vodova, 2011).

Jordanian commercial banks consider rollover risk, which is related to debt refinancing, as the most important form of funding for liquidity risk and redemption risk. This is related to redeeming fixed income instruments before or on their maturity date – a second risk they face – while the margin funding risks are less important, as shown in Table 15. Appropriate liquidity risk management must be consistent with banks' overall strategy and pay attention to daily liquidity needs (Choudhry, 2011). These results support the main hypothesis that ALM is effective in Jordanian commercial banks as liquidity risk management is consistent with banks' overall strategy. These findings are in line with the study sub-hypothesis.

3.7.6 Interest rate risk

This section provides information about interest rate risk management in Jordanian commercial banks as a way of quantifying and measuring the methods adopted to reduce the effects of interest rate risk. Table 18 summarises banks' responses to interest risk management.

Table 18: Interest rate risk

Item	Frequency	Percent	Cumulative %
Quantifying interest rate risk			
IRS gap	11	55	-----
Stress testing	5	25	-----
NIM	3	15	-----
Earing at risk	2	10	-----
CBJ interest rates	1	5	-----
Measuring the Target of Interest Rate Margin			
Risk appetite and bank strategy	5	25	-----
Cost Of Funding	3	15	-----
GAP analysis	3	15	-----
ROA	1	5	-----
ROC	1	5	-----
NPV	1	5	-----
CBJ interest rates on monetary instruments	1	5	-----
Interest rate risk management techniques			
Gap analysis	17	85	-----
Maturity ladder	17	85	-----
Simulation	8	40	-----
Methods of reducing interest rate risk			
Maturity matching of loans and deposits	16	80	-----
Floating rate loans	14	70	-----
Interest rate swaps	6	30	-----
Interest rate caps	1	5	-----
Using off-balance instruments to manage interest rate mismatches			
Yes	16	80	80
No	4	20	100
Prevailing type of instruments			
IR SWAPS	4	25	-----
Forwards	1	5	-----

Jordanian commercial banks use a range of instruments and indicators to quantify interest rate risk with 11 banks (55%) using the sensitivity gap (IRS) and five (25%) using stress testing. Other instruments and indicators are also used such as net interest margin (NIM), earnings at risk and the central bank of Jordan interest rate, as shown in Table 18.

The target of the interest rate margin in Jordanian commercial banks is measured and effected mainly by the risk appetite of a bank and the adopted strategy regarding interest rate risk management as indicated by five banks (25%) of the respondents. In addition, they indicate costs of funds and gap analysis as measures of the target of interest rate risk margin in three banks (15%). Other indicators and ratios such as ROA, ROC, NPV and CBJ interest rates on monetary instruments are used by only a few banks.

Seventeen banks (85%) use gap analysis and maturity ladders as techniques to manage interest rate risks. Eight banks (40%) use the simulation technique. Other banks also use ratio limits. Sixteen banks (80%) use the technique of matching maturities of loans and deposits, and fourteen banks (70%) use floating rate loans and interest rate swaps. Only one bank uses interest rate caps and no banks use interest rate caps. Finally, sixteen banks (80%) of the respondents rely on using off-balance-sheet instruments to manage interest rate mismatches through interest rate swaps and forward rate agreements.

3.7.7 Credit risk

This potential risk appears when a bank borrower fails to meet their contractual obligations. Banks in general should pay to this risk, which can affect their ability to extend loans. This section will presents information on Jordanian commercial banks regarding how they quantify credit risk and their methods of reducing this potential risk. Table 19 summarises the responses to the study's question on credit risks in Jordanian commercial banks.

Table 19: Credit risk

Item	Frequency	Percent	Cumulative%
Quantifying credit risk			
Risk appetite and bank strategy	5	25	-----
NPL	4	20	-----
Basel & regulatory regulations	4	20	-----
Concentration (exposures)	4	20	-----
Expected credit losses	2	10	-----
Maturity gaps	1	5	-----
Stress testing	1	5	-----
Methods of reducing credit risk			
Collateral	18	90	-----
Determining customer credit worthiness	16	80	-----
Loan commitment	12	60	-----
Credit rationing	10	50	-----
Using off-balance sheet instruments to manage credit risk			
Yes	1	5	5
No	19	95	100

The respondents indicated that they rely on various measures to quantify credit risk in Jordanian commercial banks. Five banks (25%) used appetite to quantify credit risk. Four banks (20%) used non-performing loans levels and Basel sounds and concentration level. Two banks (10%) used expected credit losses while maturity gaps and stress testing were used by one bank each (10%). Furthermore, 18 Jordanian commercial banks (90%) try to reduce their credit risk using the by collateral method. Sixteen banks (80%) determine customer credit worthiness to reduce their potential credit risk. Twelve banks (60%) use loan commitments to reduce their credit risk. Half of the banks (50%) used credit rationing, while other banks used methods such

as credit reports including concentration and credit limit ratios. Nineteen banks (95%) indicated that they do not use off-balance-sheet instruments to manage their credit risk while one bank (5%) uses interest rate swaps as off-balance-sheet instruments, as shown in Table 19.

3.7.8 Market Risk

This section provides information about Jordanian commercial banks' approach to market risk. Table 20 summarise banks' responses to market risk.

Table 20: Market risk

Item	Frequency	Percent	Cumulative%
Quantifying market risk			
VAR	8	40	-----
Standardized approach	5	25	-----
Stress testing	3	15	-----
Concentration (exposures)	3	15	-----
Gap analysis	2	10	-----
Market-to-market	1	5	-----
Other	3	15	-----
Methods of reducing market risk			
Avoiding high exposure positions	18	90	-----
Monitoring macro-financial indicators	15	75	-----
Take offsetting trading positions	10	50	-----

Some 40% of Jordan's commercial banks indicated that they rely mainly on value at risk (VaR) to quantify their market risk. Five banks (25%) use a standardized approach to market risk while three banks (15%) use stress testing and concentration (exposures). Two banks (10%) use gap analysis to quantify market risk while only one bank uses mark-to-market, as

shown in Table 20. Two banks (10%) use methods such as monitoring local and foreign financial indicators and limiting reports and calculating dollar duration (DV01) and risk appetite. Most Jordanian commercial banks (18 out of the sample of 20) try to reduce their market risks by avoiding high exposure positions. They also monitor macro-financial indicators to reduce the influence of market risk. Half of the respondents (50%) take offsetting trading positions to reduce their market risk.

3.7.9 CFP and stress testing

This section provides information regarding the existence of contingency funding plans and stress testing at Jordanian commercial banks and the frequency at which a CFP is reviewed and stress testing is performed. Table 21 summarises the responses of the Jordanian commercial banks.

Table 21: CFP and stress testing

Item	Frequency	Percent	Cumulative %
Have a CFP			
Yes	20	100	100
Review CFP on a regular basis			
Yes	20	100	100
Frequency of reviewing CFP			
Yearly	17	85	-----
Occasionally	2	10	-----
Perform stress testing on a regular basis			
Yes	18	90	-----
No	1	5	-----
Frequency of performing stress testing			
	Frequency	**Valid %**	
Quarterly	10	55.6	-----
Semi- Annual	3	16.7	-----
Daily	2	11.1	-----
Yearly	2	11.1	-----
Monthly	1	5.6	-----
Total	18	100	-----

From the results above, all 20 of the Jordanian commercial banks had a contingency funding plan (CFP) when surveyed and review their CFP on a regular basis. Most Jordanian commercial banks (85%) review their plans on a yearly basis while two banks (10%) only review theirs occasionally. Eighteen banks (90%) perform stress-testing scenarios and one does not.

In addition, ten banks (55.6%) of the eighteen that indicated that they perform stress tests mentioned that they perform stress tests on a quarterly basis. Two indicated that they perform

stress tests on a daily basis, and two others do so on a yearly basis. One bank does it on a monthly basis. The other three respondents for this question indicated other frequencies (every six months), as shown in Table 21.

A contingency funding plan is a policy and procedure that serves banks as a guideline to address liquidity shortages in emergencies (BIS, 2008). Table 22 summarises the responses of the Jordanian commercial banks regarding elements and features of their contingency funding plan.

Table 22: Contingency Funding Plan Features

	Item	Minimum	Maximum	Mean	S.D
1	A bank should develop an effective CFP to account for the outcome of alternative scenarios on liquidity positions and on risk mitigation factors.	4.00	5.00	4.40	0.50
2	An effective CFP should contain strategies to deal with liquidity shortfalls and ensure the availability of sufficient liquidity resources to meet its obligations.	4.00	5.00	4.30	0.47
3	CFP should be reviewed on a regular basis to ensure that it remains operationally robust.	3.00	5.00	4.35	0.59
4	CFP must take into account market liquidity conditions, operational constraints, the ability to raise funding, lender of last resort, and the consequences results from applying the plan itself.	3.00	5.00	4.25	0.63
5	CFP is concerned with low-probability and high-impact events that could negatively affect the available liquidity resources.	3.00	5.00	4.05	0.51
	Average			4.27	

The Jordanian commercial banks strongly agree with the statement that a bank should develop an effective CFP to account for the outcome of alternative scenarios on their liquidity positions

and risk mitigation factors. Such plans should contain strategies to deal with liquidity shortfalls to ensure the availability of sufficient liquidity resources to meet a bank's obligations, as indicated in the first and second statements with values of 4.4 and 4.3, respectively. In addition, the Jordanian commercial banks strongly agreed that the CFP should be reviewed on a regular basis to ensure that it remains operationally robust with a mean value 4.35. Furthermore, the CFP must take into account market liquidity conditions, operational constraints, the ability to raise funding, the lender of last resort, and the results of applying the plan itself with a mean value 4.25. Moreover, the respondents strongly agreed with the statement that the CFP is concerned with low-probability and high-impact events that could negatively affect a bank's available liquidity resources with a mean value 4.05.

The responses about banks' contingency funding plans have a mean of 4.27. They indicate that Jordanian commercial banks have contingency funding plans to address liquidity situations. In addition, CFPs incorporate strategies to deal with liquidity shortages. The Jordanian commercial banks review their CFP on a regular basis to ensure the validity of their procedures and take into account market liquidity conditions as well as their ability to raise funds from the central bank of Jordan. The results of the above mentioned statements were in line with the researcher expectations that CFP takes into account liquidity positions and the impact of changes in the market, even if it has a lower probability, which supports the view that Jordanian commercial banks manage their liquidity in stressed situations effectively.

Many banks are implementing stress tests to ensure their stability in the short-term as well as in the long term. The main aim of these tests is to ensure that banks can continue their operations under severe scenarios (BIS, 2009). Table 23 summarise the main elements of stress testing at Jordanian commercial banks.

Table 23: Stress-Testing on liquidity elements

	Item	Minimum	Maximum	Mean	S.D
1	Stress testing should consider alternative scenarios on liquidity positions, risk mitigation, off-balance sheet items, contingent liabilities, and must review the assumptions underlying decisions concerning funding position.	3.00	5.00	4.15	0.49
2	Stress testing should be performed on a regular basis to identify resources of liquidity stress and to ensure the adherence of the bank's units to risk exposure limit guidelines.	3.00	5.00	4.30	0.57
3	Stress testing should analyse the separate and combined impact of liquidity stress on cash flow, liquidity position, profitability, and solvency.	4.00	5.00	4.20	0.41
4	Stress testing should take market conditions, correlation between funding markets, and the scale of complexity in business activities.	3.00	5.00	4.00	0.56
5	Stress tests should highlight vulnerabilities in bank positions and propose remedial actions.	1.00	5.00	4.05	0.89
6	Stress test results should be integrated into day-to-day risk management. In addition, the results should be taken into consideration when setting risk exposure limits.	1.00	5.00	4.05	0.83
	Average			4.125	

Jordanian commercial banks strongly agreed with the statement that stress testing should consider alternative scenarios regarding liquidity positions, risk mitigation, off-balance-sheet items, and contingent liabilities, and must review the assumptions underlying decisions concerning funding positions. These statements generated a mean value of 4.15 in the five-point Likert scale. Furthermore, Jordanian commercial banks strongly agree that stress testing should be performed on a regular basis to identify sources of liquidity stress and to ensure banks' adherence to risk exposure guidelines. These statements occurred with a mean value of 4.15 in the five-point Likert scale, as indicated in Table 23. Moreover, Jordanian commercial

banks indicated that they strongly agree that stress testing should analyse the separate and combined impacts of liquidity stress on cash flow, liquidity position, profitability, and solvency. Furthermore, they agree that stress-testing scenarios should consider market conditions, correlations between funding markets and the complexity of banks' business activities. Moreover, they strongly agree on statements number five and six, which assert that stress tests should highlight vulnerabilities in banks' positions and propose remedial actions, and that the results of stress tests should be integrated into daily risk management practices and factored into the setting of risk exposure limits.

The mean of the sample's responses on the six statements about stress testing is 4.125, which indicates that Jordanian commercial banks conduct stress testing to improve their liquidity management. In addition, stress tests have alternative scenarios on liquidity positions and risk mitigation. Furthermore, stress test scenarios take into account market conditions in line with market funding and bank activities. The findings of these statements were similar to the researcher expectations in the hypothesis that stress-testing scenarios in Jordanian commercial banks are efficient in terms of improving liquidity management.

3.7.10 Reliability test

The researcher used Cronbach's alpha to test the reliability of the measurement scale and internal consistency of this study. The results indicate that Cronbach's alpha is sufficiently high and above 70%, as shown in Table 24.

Table 24: Cronbach's alpha reliability test result

Item	Value
Number of Items	232
Cronbach's alpha	0.758

3.8 Conclusion

This section of the study has used a questionnaire survey comprising of a sequence of questions to capture information from respondents. This data collection tool has been widely used by many as it can capture diverse types of primary data. The questionnaire was distributed among all Jordanian commercial banks, excluding Islamic banks as they adhere to Islamic Sharia Law, which proposes a different way of managing banks assets and liabilities. The response rate from the banks was 95.2% – a very a high rate given the small population of 21 banks in the country.

The main aim of this research is to study ALM processes and the role of ALCO in commercial banks in Jordan through distributing a survey with a special focus on liquidity management to invite respondents to describe the current state of ALM in Jordanian commercial banks and the role of asset and liability committees. However, the researcher faced some limitations, such as the limited sample population, as the Jordanian economy is a small open economy with a banking sector comprised of 21 commercial banks. Therefore, there was a limited population to be surveyed as the ALM process is concentrated in the main branches and deals with resource allocation. In addition, according to the best of my knowledge, there is a serious lack of previous studies about ALM frameworks in Jordanian commercial banks.

Many researchers have tried to identify the main elements of ALM frameworks within the context of the banking industry. In addition, they have sought to emphasise the importance of the ALCO as the implementation arm of ALM strategies and policies in order to mitigate various risks including fundamental risks and to maximise operational income. Setting the overall strategy for commercial banks to effectively manage asset-liability components requires a focus on various pillars.

The first pillar is concerned with managing banks' liquidity positions in terms of their liquid assets and maturity profiles, while taking into account the market conditions. The second pillar focuses on risks stemming from day-to-day operations, such as default risk (Choudhry, 2011). Thus, the main pillars that govern ALM frameworks are the effectiveness of ALM processes in managing asset-liability components within the context of the overall bank strategies, which is determined by managing liquidity positions while taking into account market conditions.

The effectiveness of ALM is considered one of the main factors in maximising profitability while mitigating the effects of risk factors (Bessis, 2011). The ALM framework should be compatible with the overall strategy of the bank as well as the individual business lines strategies planning, coordinating, and controlling the assets and liabilities (Charumathi, 2008). Further, the set goals of ALM should be clear and take into account various types of risks that affects banking operations, which could be mitigated through setting risk exposure limits and using various risk-mitigation tools (Zawalinska, 1999), as well as through the existence of CFP and performing stress tests periodically.

Moreover, risks stemming from banking operations concern lending and trading activities (Chorafas, 2007; Choudhry, 2011). Banks must ensure the availability of funding to meet expected and unexpected future obligations. This can be done by broadening funding sources and having adequate reserve buffers to cushion liquidity shortfalls. In addition, ALM strategies and policies should be reviewed periodically through comparing actual performance with projections (BIS, 2008; Vento & La Ganga, 2009; Drehmann, 2013). Nevertheless, the developments in liquidity management supervision set by the Basel committee have increased the regulatory burden on banks. Although ALM was identified in the Basel II pillars, Basel III introduced new management standards to strengthen internal and regulatory supervision of

liquidity management in the banking industry (Kubat, 2014). Further, regulatory authorities are paying more attention to the ALM process.

The implementation arm of ALM frameworks, the ALCO, is key to managing the ALM process and charting up strategies and policies for individual business lines as well as overall bank strategy. This is conducted through reporting analysis that focuses on lending margin, interest income, variance from last projection, customer business and future business by assessing projected returns, revenue and risk exposure. Further, they would consider the acceptance of risk exposure levels, existing risk limits, and hedging policies. The ALCO is dependent on reports from various units in the bank. Many ALM desks formulate their hedging strategy within the overall context of funding and liquidity policy. In addition, they should contain scenario planning under micro and macro level market conditions and the latest short-term projections. The evaluation process compares set guidelines with actual achievements (Bessis, 2011; Choudhry, 2012).

Therefore, an independent ALCO managing various risks is an operational safety measure (IFC, 2012). ALCO members should meet periodically to propose strategies and policies to board members. They are also responsible for setting risk exposure limits for risk metrics. Further, their focus should not only be directed towards liquidity and interest rate risk as they should have a broader view of the risks stemming from the business environment as well as the risks stemming from banking operations (Bessis, 2011; Choudhry, 2012). In addition, regulatory authorities may influence the output of the ALCO report through its legislative powers in supervising the banking sector (IFC, 2008).

The results of the study indicate that Jordanian commercial banks already have an ALM process that governs their management of their assets and liabilities and that the ALCO is

responsible for. The results also show that the ALM is effective in most Jordanian commercial banks. However, the results pointed out some actions that should be taken to increase the effectiveness of the ALM process. For instance, the results indicated that the ALCO is not responsible for setting risk metrics that quantify various risks but is only responsible for setting risk exposure limits. Therefore, risk metrics should be defined by the ALCO when they set risk limits and exposures. Furthermore, the study revealed that the inputs for the ALCO lack comprehensive reports about overall economic and financial market conditions as the study respondents indicated that they monitor these variables in order to mitigate market risk. In addition, inputs regarding credit risk concentration and forecast reports are not provided to ALCO. Thus, a remedial action should be taken by the commercial banks as ALCO is responsible for proposing strategies to the board of directors regarding liquidity positions, product lines, and the overall strategy of the commercial bank. Nevertheless, the study respondents indicated that they were neutral about the board of directors' adoption of the strategies set in the ALCO reports. Consequently, a feedback mechanism should be set between the board of directors and ALCO through the CEO in order to ensure the consistency of the overall bank strategy, noting that most of the respondents indicated that the CEO and board of directors are responsible for reviewing the ALCO report.

The banks in this study pointed out that the ALCO committee meets regularly on a monthly basis. However, the ALM strategy assessment differs from one bank to another. Thus, banks that take more time to review their ALM strategy (e.g. quarterly and yearly) could be more prone to market risks and risks stemming from structural changes in liquidity positions. Accordingly, the implementation of Basel III will increase the resilience of liquidity management policies at commercial banks, and at the same times heighten the strain on banks with regard to supervisory requirements and structural changes in liquidity positions.

The results indicated that banks perform stress testing on a regular basis (quarterly). Also, they have a CFP that is reviewed on a yearly basis. Changes in market conditions and liquidity positions due to macroeconomic and financial conditions and day-to-day operations should be taken into consideration while performing stress testing and formulating CFP plans. Accordingly, banks should harmonize CFP reviews and perform stress tests more frequently. Furthermore, 90% of the study respondents indicated that they have technical liquidity buffers, which indicates that banks hold mandatory reserve requirements at the central bank without benefiting from the remuneration period that is set by the supervisory authorities. This study also indicated that banks tend to cover liquidity shortages through the inter-bank market and by resorting to additional borrowing to ensure the availability of liquidity to meet their obligations. Accordingly, a necessary action should be taken by the supervisory authorities to ensure inter-bank borrowing as it is indicated as the main sources to cover their liquidity shortages to decrease the cost of borrowing between commercial banks.

Some 75% of Jordanian commercial banks in this survey reported that they prioritise management of liquidity risk. In addition, the financial crisis has promoted the adoption of more advanced liquidity risk policies and liquidity risk measurement methodologies (Scannella, 2016) as one of the lessons from the Global Financial Crisis was that liquidity risk can and does lead to the failure of financial institutions (DeYoung & Jang, 2016). Therefore, the next chapter will investigate more deeply the impact of bank internal factors on liquidity risk in Jordanian commercial banks. This study will help us to identify relationships that would help in mitigating liquidity risks at Jordanian commercial banks and could be applicable in commercial banks in other countries with similar characteristics to the Jordanian banking system.

Chapter Four: Liquidity Risk

4.1 Introduction

The Liquidity is the lifeline of all the business undertakings and banks that operate in the dynamic market environment, the inadequate liquidity or poor availability of cash can have a detrimental implication on their survival and sustainability (Dash, et al., 2011). Whereas, the risk that arises before a financial institution when it is not able to meet their obligations is the liquidity risk. In other words, it can be said that when the banks fails to convert the assets into cash without compromising on the capital and income , as a wide range of factors can be used by banks to assess liquidity risks (Chen, et al., 2018). In addition, there is major factors that have been identified by the literature include banks internal factors, regulatory factors, macroeconomic aspects. Furthermore, liquidity risk can have an adverse implication on the performance of financial sector as well as banking institutions in particular, affect the profitability of financial institutions and banks to a great extent. In the highly unpredictable and competitive environment, banks need to careful devise liquidity risk management that can have a major implication on their viability and sustainability (Arif & Anees, 2012). During the last decade in relation to global financial crises and new financial rules, the liquidity risk of banking has taken on such importance and become it be essential to measure, manage, and assess the impact of liquidity risk on the economics of banking (Scannella, 2016).

The impact of the global financial crisis on Jordanian commercial banks was limited due to their low exposure to the global financial system as well as the country's underdeveloped financial market, limiting its access to financial tools to diversify their portfolios. These limits have been imprinted on Jordanian banks' risk appetite as well as their market

behaviour. Jordanian banks have often been characterized as being more conservative with an emphasis on the traditional role of banks as financial intermediaries. This is apparent on their income statements as more than 60% of their revenues comes from interest rates on loans (Yaseen, et al., 2015). However, innovation in the financial markets as well as the repercussions of the Arab Spring have impacted Jordanian banks' behaviour and made them more prudent regarding their local market exposures and the quality of their liquid assets as it caused some withdrawals from banks and caused some liquidity shortages at banks.

Jordanian commercial banks size compared to other sectors in the economy promote necessity of authorities to shield this sector from the negative effects of these developments through improving the efficiency by enhancing banks' regulations and developing sound operational risk methodologies in the banking system by charting the guidelines and instructions . The existence of effective framework that mitigates risk and allocate resources more effectively is essential for the banking sector (Choudhry, 2011).

4.2 Literature Review

In this chapter, the researcher will survey the literature on liquidity management and the factors that contribute to the mitigation of liquidity risks at commercial banks. The conducted survey indicates that some of these studies were empirical and focused on both developed and emerging market banking (Pagratis, et al., 2017; Wójcik-Mazur & Szajt, 2015). Theories which are related to liquidity management have suggested strategies to mitigate liquidity risks at commercial banks and represented an extension from previous theoretical literature. In this section, the researcher will discuss and analyse liquidity risk management in the theoretical and empirical literature.

4.2.1 Theoretical Literature Review

4.2.1.1 Liquidity Risk Management Theories

The importance of the banking sector as an intermediary between depositors and creditors has triggered the motivation for laying a theoretical foundation for managing liquidity. Having a stable banking system is vital for the production process in any economy as a whole. Accordingly, many theories have emerged to enhance the banking framework through focusing on lending and investment portfolios as well as their funding base and liquidity positions. The common features of these theories are that commercial banks' liquidity positions are impacted by many factors, some of which are internal, others of which are related to regulatory authorities' conditions and the macroeconomic environment. Most of these theories indicate that maximising profits is subject to capital adequacy and liquidity considerations (Uchendu, 1995).

The importance of commercial banks' operations led to the emergence of theories that tried to explain how commercial banks operate within the ALM context (Baumol, 1954). Economists such as Keynes focused on the banking industry within a macroeconomic framework in order to explain the macroeconomic phenomenon and the dynamic interactions between economic agents' behaviour, and commercial banks and the money supply. He highlighted the use of money as a need for day-to-day activity, storage of value, and for speculation purposes (Keynes, 1936). Also, his theory set many factors that affect economic agents' choice to hold money at banks such as transactions costs, interest rates (Meltzer, 1963), and precautionary purposes (Whalen, 1966), etc. However, the Keynesian theory did not focus on profit maximisation for commercial banks and how they manage their liquidity; it only focused on commercial banks being a macroeconomic phenomenon.

Accordingly, the following will illustrate theories that have focused on commercial banking operations.

4.2.1.1.1 Commercial Loan Theory

Liquidity management theories can be traced back to Adam Smith (1723-1790) in the eighteenth century. He was the first to indicate that banks' liquidity is dependent on short-term, self-liquidating bills of exchange in the normal course of business (Humphrey, 1982). Commercial loan theory, which is also referred to as the "real bills doctrine", states that the liquidity of banks is guaranteed as long as their assets are short-term in nature and self-liquidating such as cash balances and short-term securities. This view was based on banks' lending activities to merchants, which were mainly through discounted bills, which are short-term in nature, to finance their trading, production, transportation of goods, and distribution for short periods. Accordingly, central banks could contribute in managing commercial banks' liquidity through short-term financing, which would ensure the availability of liquidity for the banking sector and appropriate money for the economy as a whole (Emmanuel, 1997; Alshatti, 2015).

Furthermore, the abundance of money supply will be in line with the economic fundamentals. Money supply will increase due to the issuance of short-term commercial bills that are backed by transactions of goods and services – real transactions (Down, 1996). The doctrine highlights the importance of lending commercial papers that are backed by real transactions, which would make securities increase in line with the increase in money supply (Humphrey, 1982). These loans are viewed in the doctrine as "self-liquidating" because loan repayment depends on normal business processes. Moreover, financing short-term loans

allows banks to have high liquid revenue assets and therefore have the ability to meet their liabilities such as demand deposits (Emmanuel, 1997).

However, the real bills doctrine ignores other types of extended credit such as land, equipment, and consumer goods acquisitions, which may be financed through banks and other financial institutions. Furthermore, the doctrine does not take into account the stability of core deposits in banks, which enables banks to extend loans for a reasonable period without becoming illiquid, as it assumes that depositors will withdraw their funds at the same time. Moreover, commercial papers' degree of liquidity depends on the circumstances of the economy as well as the use of loans by firms. Accordingly, the real bills doctrine focused on the influence on both bank lending and the general economic activities. Also, it is founded on the "needs of trade" and could be viewed as an inadequate criterion for banking regulators as central banks could not influence the business cycle as it depends on fluctuations of money supply that are based on the needs of trade. However, the shift ability theory has included the ability of banks to shift their assets through selling them to a more liquid bank, as in the below.

4.2.1.1.2 Shift Ability Theory

The shift ability theory became increasingly popular after the US entered World War I and there was a need to finance the war, which led to the issuance of large amounts of government bonds. The Federal Reserve encouraged banks to buy these bonds through amending the Federal Reserve Act, which allowed banks to offer these securities as collateral against their borrowing from Federal Reserve banks. This development, along with the growth of a national market for government issues, made these securities an attractive asset for commercial banks, and convinced them that government securities were

more marketable than loans. These securities are hence a superior source of liquidity and banks were drawn into the government securities market (Summers, 1975). These developments have led commercial banks worldwide to become holders of a significant amount of government securities as it constitutes a high percentage of their earning assets. Indeed, this change in the composition of banks' earning asset portfolios was but a deviation from a historic asset distribution pattern in commercial banking (Emmanuel, 1997).

The evolution of banking operations has led to the perception that liquidity management is an issue governed by banks' abilities to shift assets through selling them to a more liquid bank (Alshatti, 2015). According to this approach, banks could have enough liquidity through having readily marketable securities that could be converted to cash in normal conditions (Udoka, 2012). Also, it assumes that assets need not be linked to self-liquidating bills and held in other shiftable open-market assets such as government securities (Moti, et al., 2012). Moulton (1918, p. 723) mentioned that the bankers recognize that "*the way to attain the minimum in the matter of reserves is not by relying upon maturities but by maintaining a considerable quantity of assets that can be shifted to other banks before maturity as necessity may require*". This theory does not, however, focus on commercial banks' lending activities and instalment payments, which are in the centre of the anticipated income theory, as illustrated in the next section.

4.2.1.1.3 Anticipated Income Theory

After the 1930s crisis, banks started to consider new channels for their funds through focusing on financing the longer-term needs of business. When World War II ended, banks' portfolios began to shift as they started to lean towards the private sector instead of the government due to changes in resource allocations. The increase in credit activities in the

post-war era affected banks' profits as their client base started to widen in parallel with their commercial activities. The change in banks' attitudes towards long-term financing took place in parallel with their efforts of finding the right mixture of high liquid assets and other assets that could strike the balance between widening their operations and having enough liquidity to enable them to meet their commitments. These types of loans – medium to long-term loans – qualify under the 'anticipated income theory' developed in 1949 by Herbert V. Prochnow (Prochnow, 1949; Emmanuel, 1997).

The theory argues that banks can maintain their liquidity through structuring their loan payments according to expected borrower income rather than the offered collateral. Accordingly, banks will rely on debtors' income and its coverage of debt-service requirements that is determined based on cash flow projections as they provide a clear anchor about loan quality and ability to repay. Expected flows for the borrower from main operations would assure both that the loan will be self-liquidating in nature and that the borrower is able to meet the interest and principal payments.

During normal circumstances, this type of credit would function the same way as bank lending based on the commercial loan theory of liquidity. Furthermore, it has some similarities with traditional shiftability theories of bank liquidity as it assumes that banks during normal times extend loans to companies that can repay their instalments on time based on their historical relationship with the bank. Most of these firms have good management that incur profits and have contingency plans to meet short-term liquidity needs (Prochnow, 1949). According to this theory, loans will be paid off in a series of instalments, ensuring a steady stream of funds for the bank that can use them to cover their liquidity

needs. Furthermore, banks can sell these loans in the secondary markets if they face liquidity shortages (Alshatti, 2015).

Consequently, it may be concluded that banks could rely on one of these theories or a combination of them to manage their earning assets, investments and liquidity positions. However, if liquidity shortages were a widespread phenomenon, the lenders of last resort, or central banks, could provide banks with liquidity in order to face large withdrawals (Prochnow, 1949). The theory of anticipated income has some drawbacks as it could be considered as a technique to examine the creditworthiness of customers and yet this theory fails to meet emergency cash requirements. Most of the theories above have focused on managing banking activities from the asset side and have not focused on managing liquidity needs through creating more liabilities on the balance sheet. Liability management theory, however, stresses the importance of the liability side in meeting banks' liquidity needs, as discussed in the following section.

4.2.1.1.4 Liability Management Theory

Liability management theory has affected loan portfolios of commercial banks as it was founded when banks were under strong pressures when demand was growing for loans and these banks saw unparalleled growth in deposits (Emmanuel, 1997). Commercial banks can meet their liquidity needs by creating extra liabilities against them using various sources. These sources comprise borrowing from the central bank, issuing certificates of deposit (CDs), borrowing from other commercial banks etc. Therefore, liability management theory stresses the need for banks to shift their attention to the liability side of the balance sheet rather than just focusing on having high quality liquid assets (Alshatti, 2015). Liability management has been viewed as a major banking innovation and, as such, has significantly

influenced the outlook of bankers. Therefore, Emmanuel (as cited in Alshatti, 2015) states "*banks can satisfy liquidity needs by borrowing in the money and capital markets. The fundamental contribution of this theory was to consider both sides of a bank's balance sheet as sources of liquidity*". This theory only focuses on the liabilities side of the balance sheet and on the capital markets and their effects on the liquidity of financial institutions. The main resource that conventional banking relies on is time certificates of deposits; however, in times of crisis, money markets' interest rates will increase due to the increased demand for liquidity, which limits the supply of certificate of deposits (Kusy & Ziemba, 1986).

Furthermore, liability management theory has concluded that banks may construct extra liabilities through borrowing from the central bank or other financial institutions, which helps banks to acquire liquidity to fulfil their prerequisites. However, these borrowing sources are considered more costly than borrowing from different sources. Moreover, commercial banks may acquire more financing through raising capital, which secures them from various types of unsecured risks, depending on the costs of constructing liabilities to finance their operations from other resources. The volume of capital is relative to the net worth of resources, denoting the edge by which resources exceed liabilities (Saunders & Thomas, 1997).

Commercial banks should not depend on interbank markets to resolve their liquidity shortages as market rates are influenced by monetary policy operations and the mediation of central banks (Saunders & Thomas, 1997). A bank may have adequate resources to back its liabilities, and sufficient capital power, deposits and different liabilities, and through settling spreads between the interest payment assets and the cost of acquired assets to encase their common costs (Kusy & Ziemba, 1986). This creates a financial stream in the

conventional course of commercial banking as banks with adequate capital and sufficient funds that cover the liquidity demand have the ability to manage their liquidity holdings to avoid shortages or an overabundance liquidity. In this regard, a more balanced approach has been found, which focusses on the structure of both sides of the balance sheet, as discussed in the section below.

4.2.1.1.5 The Ladder Approach

The balance sheet structure could be considered a main factor that contributes to managing liquidity in financial institutions (Chaplin, et al., 2000). Accordingly, funding liquidity and liquidity conditions in the market are major factors in determining how banks manage their liquidity, as they have to be in a good position with enough liquidity to meet short-term obligations when they fall due through borrowing from the market or through liquidating some of the liquid assets in their portfolios. Banks' operations impact the level of liquidity needed by banks as they specialize in areas that determine their cash flows. Banks that focus on lending activities are more prone to liquidity shortages and should have adequate buffers to face future liquidity needs.

Accordingly, banks should pay more attention to both sides of their balance sheet and determine its structure through matching their assets and liabilities through comparing cash flows and time horizons (De Haan & Van den End, 2013). In addition, banks need to assess existing conditions and market potential of the expected behaviour of maturity for their assets and liability positions and take whatever steps are necessary to meet their unexpected liquidity needs. Liquidity risks stem from various resources related to day-to day operations with regards to lending and trading activities (Chorafas, 2007). Inability to meet their obligations will render a bank in default (Drehmann, 2013). Accordingly, banks are

responsible for ensuring the availability of funding to meet expected and unexpected future obligations without affecting their daily operations or the financial position of the institution, which is known as liquidity risk funding, over a specific horizon with reasonable costs (Basel Committee on Banking Supervision, 2008; Drehmann, 2013; Vento & La Ganga, 2009).

4.2.1.2 The Evolution of Liquidity Management Theories

Theoretical frameworks emerged to facilitate discussion of the role of the banking system in the economy. These have focused on the banking industry within a macroeconomic framework in order to explain macroeconomic phenomena and the dynamic interactions between economic agents' behaviour, commercial banks and money supply. Liquidity risk management theories have highlighted the use of money in day-to-day activity, as a store of value and for speculation purposes (Keynes, 1936). Also, they have set many factors that affect economic agents' choice to hold money at banks such as transactions costs, interest rates (Meltzer, 1963), 'precautionary purposes' (Whalen, 1966), etc. However, these theories have not focused on profit maximisation for commercial banks and how these banks manage their liquidity.

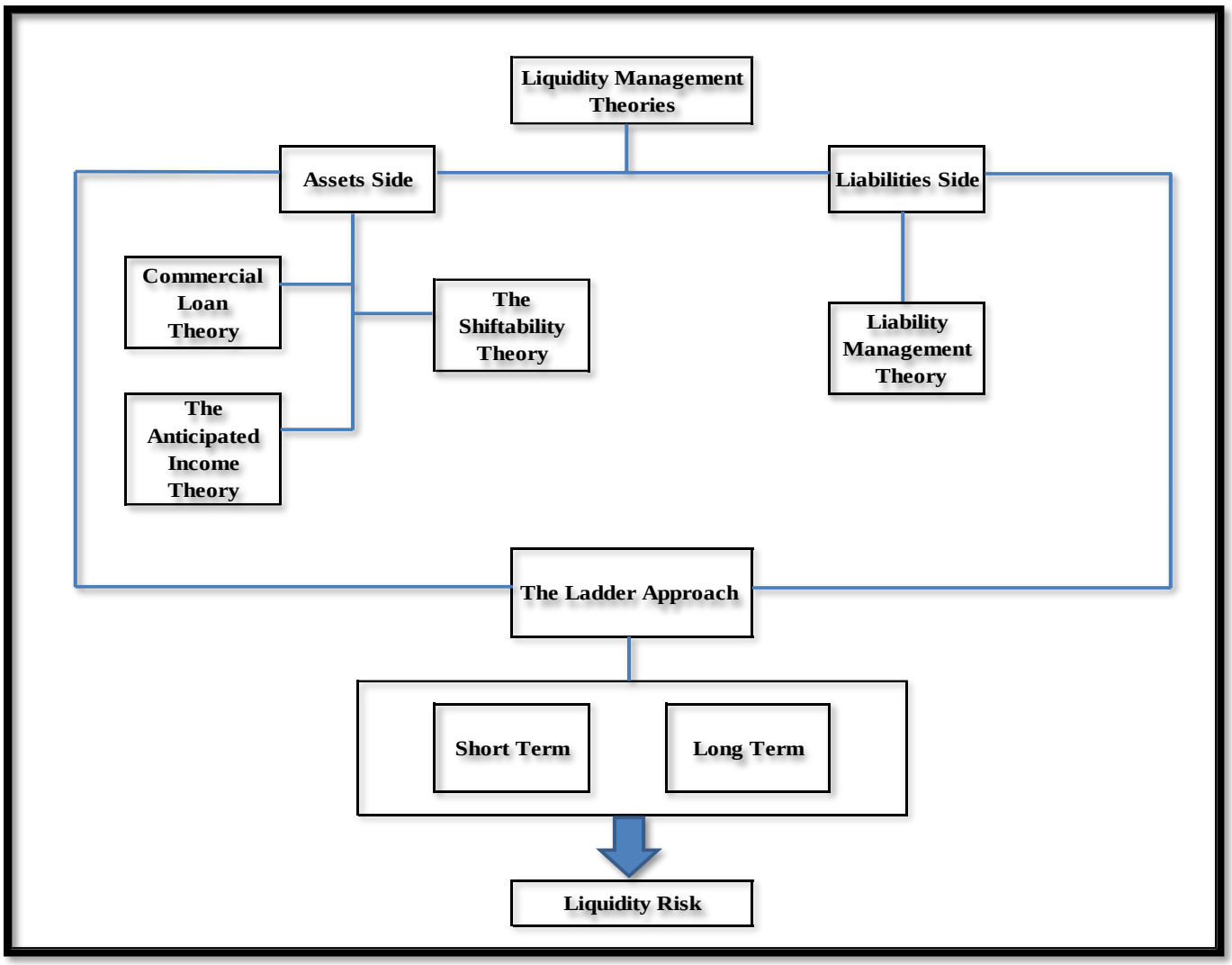
Later, some theories emerged to explain how commercial banks operate within the context of ALM (Baumol, 1954). These theories suggested liquidity management strategies. Following the commercial loan theory, banks were focused on short-term, self-liquidating loans to ensure the availability of liquidity to meet their needs. Financing short-term loans allows banks to have high liquid earning assets and be capable of meeting their demand-deposit liabilities. The shift ability theory represented an extension of the previous theoretical literature through recognizing that liquid assets could be used to meet liquidity

needs (Klein, 1971) through banks shifting their assets by selling them to more liquid banks in the secondary market before they matured. Banks could have enough liquidity through having readily marketable securities that could be converted to cash in normal conditions (Udoka, 2012). Also, it assumes that assets need not be linked with self-liquidating bills and held in other shiftable open-market assets, such as government securities (Moti, et al., 2012).

The anticipated income theory suggested that borrower's expected income is one of the major determinants for instalment amounts to loan payments. Banks that have high quality management could include a certain amount of loan investments that are expected to be liquidated in line with the abovementioned theories or through a combination of them. In the case of large withdrawals from the banking system, the central banks may intervene through ensuring the availability of liquidity for banks (Prochnow, 1949).

Liability management theory includes commercial banks' ability to fulfil their liquidity needs by borrowing in the capital and money markets (Alshatti, 2015). This requires available sources of liquidity to be matched to expected needs. However, the importance of balance sheet structure for financial institutions' viability in turn stresses the importance of matching assets and liabilities over set time horizons. Banks need to assess the impact of current and potential market conditions on the predictable behaviour for their asset and liability positions and take any necessary steps to meet their unexpected liquidity needs. These theories highlighted many important factors that affect liquidity management and could increase the levels of liquidity risk that may stem from various resources related to day-to day operations with regards to lending and trading activities (Chorafas, 2007). The potential match between both sides of the balance sheet in terms of maturity and sensitivity to interest rates minimises liquidity and interest rate risks (Zawalinska, 1999; Belete, 2013).

Figure 26: Liquidity Management Theories[21]



The main concern of the above-mentioned theories is to ensure the viability of the banking sector through analysing balance sheet operations and increasing banks' effectiveness in mitigating risks. These theories have focused on preserving enough liquidity in banks through encouraging them to focus on their short-term operations through self-liquidating loans to ensure the availability of liquidity, structuring their loan payments according to the expected cash flows of their borrowers rather than the offered collateral, having readily

[21] This figure depicts the evolution of liquidity management theories and their main focus as some of these theories focused on managing banks operations on the assets side whereas others have focused on managing the liability side. The ladder approach suggests matching assets and liabilities within time horizons to mitigate liquidity risk.

marketable securities that could be converted to cash in normal conditions (Udoka, 2012), borrowing from capital markets, and matching their assets and liability positions to meet their unexpected liquidity needs. The next section presents a survey of the recent empirical literature about liquidity risk.

4.2.2 Empirical Literature

Recent literature investigated the impact of internal factors on liquidity at banks while taking into account other external factors. Some studies indicated that internal factors are the dominant variables that affects liquidity at banks, while other external factors such as the macroeconomic environment had limited or no impact on liquidity risk (Roman & Sargu, 2015; Zaghdoudi & Hakimi, 2017; Wójcik-Mazur & Szajt, 2015). These results points to the importance of the individual characteristics and the role of management. On the other hand other studies focused on key sources of vulnerability for liquidity funding (Pagratis, et al., 2017) and how banks seek to mitigate the impact of mismatches on their performance (Bessis, 2010; Bonfim & Kim, 2012).

The following section will discuss the existing empirical literature that has investigated the relationship between liquidity risk and other bank-specific factors. The surveyed empirical literature can be segmented into two main streams: one that focuses on the analysis of banks in multiple country studies, and the other that places emphasis on the examination of banks in single country studies. The main findings of these studies were that bank-specific factors, i.e. internal factors, have a major impact on liquidity risk faced by banks, as shown below. After surveying the existing literature, the researcher found that only a handful of studies have incorporated Jordan in their study samples due the limited availability of data for the country. Those that covered Jordan reported the low financial complexity in its financial

markets, and the conventional methods that commercial banks in Jordan employ in setting their strategies (Almumani, 2013). However, the literature on the determinants of liquidity risk for Jordanian banks is relatively scarce, and to the best of the researcher's knowledge, the empirical research available was mostly focused on the case of the advanced economies (Roman & Sargu, 2015).

4.2.2.1 Liquidity risk

The survival of banking institutions in the current financial system depends mainly on their ability to meet their contractual obligations by ensuring the fulfilment of their needs of cash, liquid assets and collateral through synchronizing their funding resources in ordinary and crisis conditions (Federal Reserve, D.B.S.R., 1994). The liquidity of an asset depends on its convertibility and speed of conversion to cash with no or little loss (Nader, 2002). Thus, liquidity risk is the uncertainty surrounding the speed and availability of convertibility of an asset in a functional market in which there is active trading in the asset. The potential loss for the institution arises from its inability to meet its obligations when they fall due without incurring high costs.

Accordingly, liquidity risk stems from the inability of firms to raise funds to meet their financing needs, or from their inability to execute transactions at prevailing market prices due to a lack of appetite among other market parties. This risk can adversely affect a bank's earnings and capital. Thus, banks must ensure the availability of funds to face the demands of their depositors and borrowers at an acceptable cost. Liquidity risk is considered one of the main threats for financial institutions and their stability; therefore, liquidity buffers are crucial for liquidity risk management and to insulate these institutions against liquidity shocks (Khan, et al., 2017).

However, the vulnerability of the banking system to liquidity risk can be summarized through their main role, which focuses on using short-term funds and transforming them into long-term loans. Employing stress test scenarios for liquidity risk at US commercial banks amid the global financial crisis of 2007-2009, Pagratis et al. (2017) identified key sources of funding vulnerabilities, and concluded that large time deposits are the dominant funding vulnerability, whereas government securities largely support other classes of liquid assets. Consequently, banks should focus on managing their liquidity to enable them to meet their obligations as they fall due without incurring unacceptable losses (Basel Committee on Banking Supervision, 2008). Many studies have defined liquidity risk as the ability of financial institutions to meet and settle their obligations as they come due (Basel Committee on Banking Supervision, 2008; Chorafas, 2007; Federal Reserve, D.B.S.R., 1994; Drehmann, 2013; Choudhry, 2011; Vento & La Ganga, 2009).

The ability of a bank to meet its obligations depends on the condition of the macroeconomic environment, the financial sector and entity specifics (Choudhry, 2011). Further, liquidity risks stem from various resources related to day-to day operations with regards to lending and trading activities (Chorafas, 2007). Therefore, the inability of these institutions to meet their obligations will render the bank in default (Drehmann, 2013). Accordingly, banks are committed to ensuring the availability of funding to cover expected and contingent future obligations without affecting their day to day operations or financial position, which is known as liquidity risk funding, over a specific horizon with reasonable costs (Basel Committee on Banking Supervision, 2008; Drehmann, 2013; Vento & La Ganga, 2009).

The above-mentioned definitions have illustrated that there are three main sources of liquidity risks that could affect banks, namely: systemic risk, idiosyncratic risk, and

technical risk. Systemic risk can be attributed to market-wide risk, and under this category fall all external risk factors to the bank, such as market disturbances, lack of central bank funding or failure of the market mechanism in turning assets into cash. Individual or idiosyncratic risk is attributable to internal factors in the bank such as poor management, the disclosure of high losses or the loss of trust by clients, which reduces the bank's ability to refinance its obligations and attract new ones. The technical risk can be created through the timing of the bank's cash flows, i.e. when liquidity is available at the bank. Commercial banks could have large inflows in distant periods. However, in the short term, banks may have significant outflows that outweigh their liquidity buffers, and this creates mismatches in the cash flows (Adalsteinsson, 2014).

Accordingly, banking activities with regards to funds management and maturity transformation is important for the process of liquidity risk (Diamond & Dybvig, 1983; Rajan & Bird, 2003). Mismatches between assets and liabilities' maturities create mismatch gaps, which constitute structural risks that are determined by the nature of funding resources and lending policies. As a result, banks are continually seeking to match their assets' maturities with their short-term and medium-term funding resources. Such dependency presents the taxonomy of liquidity risk (Bessis, 2010; Bonfim & Kim, 2012). To manage liquidity risk, banks tend to maintain liquidity buffers that are comprised of market liquid assets in order to anticipate and meet liquidity demand within a reasonable timeframe. Thus, banks and other deposit-taking institutions tend to benefit from pooling liquidity to a large group of depositors (Diamond & Dybvig, 1983). However, researchers cannot observe banks' exposures to liquidity risk directly, but it is possible to perceive their structure, operations and changes in their liquidity buffers, which allows for the prediction of the manner in which internal and market factors affect their liquidity buffers.

4.2.2.2 Bank-specific Factors

Sources of liquidity risk indicate that internal factors that contribute to commercial banks' performance have a major impact on the management of their liquidity (Roman & Sargu, 2015; Zaghdoudi & Hakimi, 2017). For example, some researchers indicated that the internal determinants of banks impact their liquidity risk, regardless of the liquidity risk measure that is adopted or the country in which it is operating. (Wójcik-Mazur & Szajt, 2015). Accordingly, the individual characteristics are the bank-specific factors of the bank, which affect its performance. These factors are influenced by internal decisions adopted by the banks' senior management. Consequently, controlling these factors is within the remit of the management board and differs from bank to bank according to their strategies, policies and procedures. These factors include the level of capitalization, credit and deposit portfolios' composition, size, interest rates, management quality, bank size, profitability, concentration, disclosure and others. Empirical literature shows various approaches for approximating bank performance through using financial ratios for profitability or more complex measures such as composite indices to measure the effects of these factors on liquidity risk (Dang, 2011). The following sub-sections will discuss the main internal factors that are affected by liquidity risk, namely: profitability, credit risk, bank size, capital, and other factors such as quality of management.

4.2.2.2.1 Profitability

There is a large body of literature that investigates the factors that affect commercial banks' profitability. The empirical studies on bank profitability have focused on specific countries (e.g. Berger, 1995; Angbazo, 1997; Barajas et al., 1999; Kosmidou, 2008; Naceur, 2003;

Badola & Verma, 2006; Heffernan & Fu, 2010; Lui & Wilson, 2010). [22] In addition, important studies have emphasized analysis of multiple countries (Bonner, et al., 2015; Wójcik-Mazur & Szajt, 2015; Demirgüç-Kunt & Huizinga, 2010; Barth, et al., 2003; Molyneux & Thornton, 1992; Bourke, 1989; Demirgüç-Kunt & Huizinga, 1999). However, the main focus of these studies was bank profitability as a measure of performance, and these studies also tried to deduce the main factors that impact profitability. This section focuses on the empirical literature that has investigated the influence of bank profitability on liquidity risk.

Empirical evidence shows that liquidity risk has a mixed influence on bank profitability depending on the type of financial model the banks operate. These findings may be attributable to the banks' capital structure as greater bank capital reduces liquidity creation (Diamond & Rajan, 2000). For example, Molyneux and Thornton (1992) studied the main determinants of bank performances across 18 European countries over 1986 to 1989 and found an inverse significant relationship between profitability and liquidity holdings, measured by cash, deposits and securities as a percentage of total assets as liquidity holdings represent cost to banks. Furthermore, Bourke (1989) studied individual characteristics and exogenous determinants of profitability in 12 countries in Europe, North America and Australia, and found a significant positive relationship between liquidity and bank profitability. These results are counter-intuitive as profitability would result from a rise in the risk appetite and employing available resources to increase lending, which would result in a decline in the level of liquidity holdings at banks. Therefore, it could be explained that

[22] These studies have focused on the following countries: the US, Colombia, Greece, Tunisia, India, China and Japan.

higher profitability tends to attract more depositors due to the bank's strong financial position, which increases the amount of available resources, hence liquidity holdings.

Moreover, other studies have indicated the existence of a negative effect between liquidity and profitability. For instance, Barth et al. (2003) studied a large sample of banks across 55 countries, and focused on the impact of banks' supervision structure, scope and autonomy on banks' profitability. Their results illustrated the existence of a relatively weak influence of supervision on the profitability of banks and an adverse effect of liquidity on profitability measured by return on assets.

Kosmidou (2008) studied the determinants of banks' profitability in Greece during the period 1990-2002, and found that the liquidity ratio is negatively related to return on average assets (ROAA). In addition, Demirgüç-Kunt and Huizinga (2010) studied various banks (1,334 banks) from 101 countries over the period 1995-2007 and concluded that banks' income and funding strategies could be determined simultaneously. Their results indicated that a higher non-interest income or non-deposit funding share evokes materially higher bank risk, but it is difficult to establish the impact of either variable on the ROA due to endogeneity concerns.

Furthermore, empirical evidence in the literature suggests that banks with high liquidity holdings tend to have lower interest rate margins. Demirgüç-Kunt and Huizinga (1999) studied a sample of a large number of countries (80 countries) during the period 1988-1995 and found that interest margin differences and bank profitability reflects individual characteristics and that funding resources, including customers' deposits and short-term funding do not have a significant impact on net interest margins despite the fact that it lowers banks' profitability.

Furthermore, Demirgüç-Kunt and Huizinga (1999) concluded that the liquidity ratio negatively affects ROA and positively affects NIM when banks are facing increasing costs due to reserve requirements and restrictions set by supervisory authorities on lending through credit and macro-prudential measures. In addition, indirect costs are responsible for lowering net interest income. Also, Wójcik-Mazur and Szajt (2015) used a dataset of 19 advanced economies' commercial banks in 1994-2006 to research the causes of liquidity risk and found a long-term relationship between liquidity risk and the interest rate margin ratio. They attributed it to the impact of lending activities of commercial banks on the margin increase. However, they found a positive insignificant short-term relationship between these variables. The reason behind that is the level of the lending activity; the greater credit growth may result in a significant increase in NIM.

However, in the longer term, banks would require additional financing resources, which would increase the costs incurred by banks. However, their magnitude is smaller than the outcome generated, which does not lower the margin but makes the relationship statistically insignificant. Moreover, Wójcik-Mazur and Szajt (2015) found a negative significant impact between liquidity risk and the total asset return rate, which suggests that financing the increasing lending activity requires the search for additional financing sources, with costs higher than traditional deposits. These results are similar to some past studies (e.g., Barth et al., 2003; Kosmidou, 2008; Demirgüç-Kunt & Huizinga, 1999; Sufian & Chong, 2008). Moreover, Pagratis et al. (2017) investigated the relationship between profitability and liquidity risk in the US using quarterly data from 2002 up to the financial crisis (2002:Q1–2009:Q1). They found that some banks can face some restrictions in accessing wholesale funding due to their size, which implies that small banks aim for higher interest rate margins compared to larger banks due to their higher dependence on net interest income

as a main factor that constitutes the majority of their profits. Others concluded that size has no effect on profitability (Athanasoglou, et al., 2008). Please refer to Appendix 3 Table 38, which summarizes the main studies that investigated the effects of profitability on liquidity risk.

4.2.2.2.2 Credit risk

Although a large body of literature has investigated the mutual impact between credit and liquidity risks, few studies, to the best of my knowledge, have analysed the interactions between those risks and their effects on commercial bank financial ratios over time. Moreover, there is no theoretical consensus on a certain model that reflects how these risks should interact with each other (Imbierowicz & Rauch, 2014). However, the influence of credit risk is considered the main determinant of bank lending behaviour. Credit risk arises when a bank's customers fail to meet their obligations. Thus, a rise in customer defaults will put pressure on banks' capital and decrease their risk appetite. Therefore, credit risk is associated with negative bank lending growth. Accordingly, banks can lend more credit to risky borrowers if they improve the way of managing their credit risk. Therefore, the advantage of improving banks' risk management abilities is that it may result in greater credit availability instead of reducing overall risk in the banking system.

Some researchers have indicated that equilibrium in loan markets depends on banks' credit rationing behaviour based on borrowers' probability of repayment and the riskiness of loans (Stiglitz & Weiss, 1981). This supports the empirical findings that greater exposure to credit risk reduces banks' willingness to grant loans as banks may suffer from higher loan losses if the increase was due to a shift in credit supply (Keeton, 1999). Other studies emphasized these findings and found a modest effect of bank capital ratio changes on lending

(Berrospide & Edge, 2010). Moreover, the appetite for risk could be considered a crucial determinant for banks' lending behaviour. The increase in long-term interest rates could change the risk appetite which would restructure banks' balance sheets by moving away from government securities to increase their lending to the private sector (Peersman, 2011).

These findings suggest the importance of setting banks' credit risk exposures and the need for monitoring lending activity as such exposures have a major impact on liquidity holdings. The impact of credit risk on liquidity risk is positive in most of the surveyed empirical literature. Roman and Sargu (2015) indicated that impaired loans have a negative impact on liquidity, which is one of the major internal factors in the CEE countries.[23] Other researchers investigated the effects of credit risk on liquidity indicators and some concluded that they have a significant impact. For example, Roulet (2018) gathered a sample of European commercial banks from 22 countries over the period 2008-2015 and found that liquidity ratios have positive but perverse effects on bank-lending-growth. These findings back the necessity for factoring in the heterogeneous characteristics of commercial banks before imposing new regulations.

Furthermore, Roulet (2018) concluded that liquidity, measured by the ratio of the non-required amount of stable funding to total assets, has a positive impact on European banks' lending activity growth. However, it has a negative impact on retail extended credit. Moreover, European banks could decrease their exposure to credit retail lending when they are under pressure through having sufficient buffers. This result is consistent with a low interest rate environment, which is similar to the period after the Global Financial Crisis.

[23] CEE countries include: Bulgaria, Romania, Czech Republic, Hungary, Latvia, Lithuania, and Poland.

Also, Roulet (2018) pointed out that funding structures are an important factor in banks' lending activities as the results indicated that the ratio of available stable funding to total assets (liquidity measure) had an insignificant impact on banks' lending activities.

Diamond and Rajan (2005) showed that the impact of credit risk on liquidity risk is positive. The authors concluded that if banks fund many projects with loans, they (the banks) could not meet depositors' demands, which may trigger them to claim their funds' back if their assets' value have declined significantly. This implies that liquidity risk and credit risk increase simultaneously. Other researchers studied the reciprocal relationship between credit risk and liquidity risk. For example, Acharya and Viswanathan (2011) investigated the relationship between credit risk and liquidity risk for Iranian banks during the period 2005-2012 and concluded that credit risk and liquidity risk have a positive and significant impact on each other.

On the other hand, Ejoh et al. (2014) surveyed a sample of 80 respondents (banks) in Nigeria to assess the degree to which the impact of credit risk and liquidity risk influences the probability of bank defaults risk among deposit money banks. They concluded that there is a significant positive impact between credit risk and liquidity risk which illustrates that an increase in non-performing loans (credit risk) causes a bank to be more illiquid. Also, Imbierowicz and Rauch (2014) investigated the relationship between credit risk and liquidity risk using a sample of US commercial banks data for the period from Q1 1998 to Q3 2010. They concluded that there is no economically meaningful relationship between liquidity risk and credit risk. However, the study found that the interaction between liquidity risk and credit risk increases the probability of default among banks, which calls for joint management of liquidity risk and credit risk in banks.

Wójcik-Mazur and Szajt (2015) analysed the determinants of liquidity risk for nineteen advanced economies' commercial banks and concluded the existence of a negative relationship between liquidity measures and credit risk both in the long and short term. This implies the cyclical nature of liquidity risk as the strong increase of lending activity in relation to the volume of acquired deposits is accompanied by the decrease in credit risk. However, others argued that there is little evidence to support any reliable effect of liquidity risk and credit risks in US commercial banks. For example, Imbierowicz and Rauch (2014) analysed the relationship between liquidity risk and credit risk for US commercial banks during 1998-2010, and they concluded that both risk categories do not have an economically meaningful reciprocal contemporaneous or time-lagged relationship. However, they found that the relationship has an influence on default probability. The dynamism between credit and liquidity risks depends on the characteristics of the bank and accordingly could decrease the risk of default.

Also, Kim and Sohn (2017) used data for commercial banks in the US during the period 1993-2010 to investigate the effects of banks' capital on extending loans that are reliant on liquidity levels. The researchers found that banks with a higher capital structure could affect banks' lending positively, as measured by the growth rate of net loans and unused commitments, and are often related to larger banks with sufficient liquidity, especially during the Global Financial Crisis. Consequently, banks' capital could have a positive impact on banks' credit but only if the bank has sufficient liquidity buffers.

Credit risk, liquidity and capital interrelations have been investigated in the GCC countries. For instance, in a study by Ghosh (2016), a data sample that covers the period of 1996-2012 was used. From the findings, the author concluded that banks with higher liquidity ratios

tend to have lower loan growth rates. This effect had increased during the global financial crisis, which implies that credit risk and liquidity risk are positively related. His analysis illustrates that smaller banks tend to hoard more liquidity in response to higher loan portfolio risk. This finding is consistent with Kashyap and Stein (2000) who reported that small banks require higher high-quality liquid asset buffers due to frictions and higher costs of accessing uninsured wholesale funding.

However, other views can be found in the empirical literature showing that after the global financial crisis, liquidity had an impact on bank lending as more strict liquidity requirements were set by regulatory authorities on banks. These requirements reduced the commercial banks' lending activities, especially when economic conditions saw monetary policy ease with a zero lower bound in interest rates and low interest rates on government bonds (Berger & Bouwman, 2009). Please refer to Appendix 3 Table 39, which summarizes the main studies that investigated the effects of credit risk on liquidity risk among banks in multiple countries.

4.2.2.2.3 Bank size

The size of a financial institution has been widely used in empirical literature as a proxy for its importance (Kosmidou, et al., 2017). Some studies have expressed that size is a crude measure for the exposure of the firm to the financial system (Cahan, 1992). Bank size is a control variable that is widely used to control for differences in firm size, and many researchers have included bank size as a variable when studying liquidity determinants explicitly as bank failures could be associated with their size.

Liquidity risk varies depending on bank size (Berger & Bouwman, 2009), and some studies have focused on the effect of bank size on performance. Accordingly, Berger and Bouwman

(2009) found that the effects of bank size have two different signs depending on the market structure and the regulatory and operational frameworks in each country (Asiri, 2007; Ali, et al., 2011; Belete, 2013; Laurine, 2013). Roman and Sargu (2015) examined the effects of bank-specific factors on liquidity risk for the period 2004-2011 in the CEE countries. These results illustrate that the effects of these factors on overall liquidity are divergent. Accordingly, large banks will attract more clients and increase their liquid assets using the crowding-in effect.

Studies that have focused on the determinants of liquidity buffers at commercial banks added another dimension related to the existence of liquidity regulations. For example, Aspachs et al. (2005), Agénor et al. (2004) and Delechat et al. (2012) concluded that there is a negative effect between liquidity buffers and bank size. Larger liquidity buffers should be sought by smaller banks as they have higher funding costs (Kashyap & Stein, 2000); on the other hand, larger banks' overall liquidity needs may be relatively lower as they face lower funding costs, which promotes them as a safe haven to avoid times of high uncertainties and systemic risks (Gatev & Strahan, 2006). Nonetheless, larger banks face liquidity risks that stem from different sources, which are regulated by supervisory authorities (Acharya & Merrouche, 2012).

Other studies have concluded that liquidity ratios have a positive relationship with size and capital. For instance, Vodova (2011) studied the causes of liquidity risk using 22 banks during 2006-2009, and found that large banks have lower liquidity targets as they rely on the government and the lender of last resort in the case of shortages. These views support the notion that large banks may induce moral hazard behaviour that causes them to bear excessive risks, with the anticipation that the authorities will bail them out given that the

regulators may be reluctant to close them (Farhi & Tirole, 2012). Also, large banks that engage in multiple activities could be translated into higher systemic risks due to the low quality of management and low governance. Thus, systemic risk could be greater with the increase of bank size. Relevantly, Laeven et al. (2016) studied the systemic risk of large banks during the recent financial crisis to identify bank-specific factors that determine risk using a sample of 412 deposit-taking institutions from 56 countries. They found strong evidence that systemic risk increases with bank size.

Bank size effects have been investigated in relation to the credit channel. For instance, Domac and Ferri (1999) examined whether East Asian countries[24] were suffering from a credit crunch after the Asian crisis in 1997, and they concluded that the credit crunch was negatively affecting East Asian economies, particularly small-sized banks and enterprises as they were facing tighter constraints accessing credit markets. Also, Bonner et al. (2015) used data from nearly 7,000 banks from 30 OECD countries for the period 1998-2007 and found that the relationship between bank liquidity buffers and bank size is affected by liquidity regulations that are imposed by supervisory authorities on liquidity, which indicates that these regulations act as a substitute for bank liquidity management. These results are similar to DeYoung and Jang (2016) who used data on US commercial banks for the period 1992-2012 and concluded that larger banks tend to have lower liquidity targets than smaller banks but manage these targets more efficiently, given that most of these banks are large in size and that he liquidity costs for their bailouts are considered substantial (Gorton & Huang, 2002).

[24] East Asian countries include: Indonesia, South Korea, Malaysia, the Philippines, and Thailand.

The effects of bank size on performance have received considerable attention in recent debates. In this regard, Hughes and Mester (2013) investigated the effects of bank size on performance through the scale economies. In their study, they used data from 842 top-tier bank holding companies in the United States in 2007 and found evidence that economies of scale exist at smaller banks and are even larger at large banks. They attributed their findings to technological advantages such as diversification and the spreading of information costs and other costs that do not increase proportionately with size. Bank size, through economies of scale, may influence the relationship between capital, risk and efficiency, as banks that are described as efficient can produce more output parts, which include liquid and other assets.

Meanwhile, Altunbas et al. (2007) studied the relationship between capital, risk and efficiency for a large sample of European banks between 1992 and 2000. They concluded that loan loss reserves and loan growth are inversely linked, and that the size of bank affects the level of their riskiness – large commercial banks appear to be less risky than their smaller counterparts, while bigger efficient and inefficient banks also seem to have lower loan-loss reserve levels. Also, they found that banks with higher capital and liquidity levels have more exposure to various risks, which confirms the need for regulators to encourage banks to hold more capital and liquidity to cover their risks.

Kim and Sohn (2017) reported that the effects of bank capital on lending differ depending upon the level of bank liquidity across bank sizes; their results showed that liquidity ratios' coefficients are statistically significant and that the size effect is negative, which indicates that small banks focus on traditional lending activities to the non-financial sector, and therefore supply lending relatively more willingly than large banks do. Their results suggest

that large and medium banks rely on market funding to finance their lending activities while small banks face some impediments in accessing market funding. Please refer to Appendix 3 Table 40, which summarizes the main studies that investigated the effects of bank size on liquidity risk among banks in multiple countries.

4.2.2.2.4 Capital

The implementation of the Basel I & II accords increased investigations into the capital rules introduced, the role of capital on banking performance, and lending activities. With the breakout of the Global Financial Crisis in 2008, the Basel committee introduced liquidity assessment measures and tightened capital adequacy rules in order to ensure banks' viability and achieve financial stability (Ben Naceur & Roulet, 2017). Systemic risks were at the heart of the debates after the Global Financial Crisis; capital ratios, bank size and liquidity management are considered the main determinants of risks within the banking sector. Large banks were at the centre of these debates as they tend to have lower capital ratios, less stable funding, and more exposure to potentially risky market-based activities (Laeven, et al., 2014). The Basel III accord address liquidity risk in banks using LCR and NSFR ratios.

Several researchers supported the view that large banks contribute to systemic risk as they tend to engage in risky activities that are financed with short-term debt, which makes them more vulnerable to liquidity shocks and shortages (Kashyap, et al., 2002; Shleifer & Vishny, 2010). However, Laeven et al. (2016), using a sample of 412 deposit-taking institutions from 56 countries, found evidence that systemic risk is lower in more capitalized banks, with the effects particularly more pronounced for large banks. Also, Banerjee and Mio (2017) used data on UK banks to study the effects of liquidity regulation on banks' balance sheets. They found evidence that well-capitalized banks experience stronger growth in their

balance sheets, accumulate less high-quality liquid assets, make efficient use of short-term intra financial loans, and have healthier growth in their non-financial sector lending portfolios.

Others have concluded that capital regulations have a negative impact on bank performance and liquidity ratios. For example, Roulet (2018) used data on commercial banks in Europe to investigate the impact of the new Basel III capital and liquidity regulations on bank lending. The evidence supported that capital ratios have a significant negative impact on large European retail lending growth and other types of lending over the post-2008 financial crisis period.

Kim and Sohn (2017) used a sample of quarterly observations of insured US commercial banks to examine whether the effect of bank capital on lending differs depending upon the level of bank liquidity. They indicated that a positive impact of capital can be noticed on credit growth rates but only for large banks. This link was significant during the period of the Global Financial Crisis. Accordingly, researchers stressed the positive impact of capital on credit only when banks have sufficient buffers. The coefficients of capital ratios with credit growth are dependent on banking size. The results were insignificant for large banks, but significant and positive for medium and small banks.

The impact of the new Basel III capital and liquidity regulations has been thoroughly investigated following the 2008 Global Financial Crisis. Ben Naceur and Roulet (2017) used a data sample from 23 countries, mostly developed, over the period of 2008–2015. Their results indicated that capital ratios do not have a significant effect on credit growth at European banks, but capital regulatory measures represented by Tier I and Tier II have a significant negative impact on European banks' credit growth. However, they found that

capital ratios have a significant negative impact on credit growth at US banks. Moreover, the study found a positive impact of liquidity ratios, measured by the non-required amount of stable funding to total assets, on credit growth in both European and US banks. Their findings indicate that banks tend to hold liquidity buffers and increase their holdings of liquid assets when they expand their risky activities to avoid liquidity shortages, and improving their ability to absorb risks.

Also, Vodova (2011) used a set of data from 22 banks during 2006-2009 to investigate the causes of liquidity risk. The results indicate that liquidity does not increase with bank size – in fact, they indicated that large banks have lower liquidity ratios as they rely more on the lender of last resort, the central bank, in case the bank is facing pressures that threaten its viability. On the other hand, increases in capital adequacy have a positive impact on bank liquidity. Bonner et al. (2015) studied the determinants of liquidity holdings using a large sample of commercial banks, and they found that an increase in the capital ratio increases banks' liquidity holdings. Furthermore, capital has moderate effects on a financial institution's liquidity buffers as the presence of liquidity regulations neutralizes most of the bank and country-specific factors that affect the size of commercial banks' liquidity buffers.

Laeven et al. (2016) studied the systemic risk of large banks during the recent financial crisis to identify bank-specific factors that determine risk using a sample of 412 deposit-taking institutions from 56 countries. Their results validate the Basel approach of addressing systemic risks through capital surcharges rather than activity restrictions or liquidity tools as bank capital has a greater impact on systemic risks than bank funding or activities.

Pagratis et al. (2017) investigated the relationship between profitability and liquidity risk in the US using quarterly data from 2002 up to the financial crisis (Q1 2002 to Q1 2009). They

found that the capital adequacy target is higher for smaller banks as they have a larger Tier I ratio than large banks. Also, they found that precautionary high-liquid assets are crucial for maturity transformation; however, they have low yield, which reduces banks' profitability. Please refer to Appendix 3 Table 41, which summarizes the main studies that investigated the effects of bank capital on liquidity risk among banks in multiple countries.

4.2.2.2.5 Other internal Factors

Other internal factors that affect liquidity management in commercial banks have been thoroughly discussed in the recent literature. For example, Almeida et al. (2004) illustrated that firms with higher financial constraints hoard more liquid assets. Therefore, the inability to access funding for firms may hinder banks through increasing their assets as they will have higher credit constraints. Thus, Delechat et al. (2012) found that financial development and management quality impact liquidity levels positively. Recently, many financial crises were caused by uncertainty over a bank's solvency, which stressed the importance of banks' disclosure requirements to complement regulation (Bonner, et al., 2015).

Ratnovski (2013) focused on the importance of transparency within the banking sector as it allows banks to attract more funds and face some liquidity withdrawals. However, banks should always focus on liquidity requirements and complement them by adopting measures to improve access to market and bank transparency. In addition, he found that the government could choose to drive banks to adopt more transparency measures through decreasing their alternative costs. In addition, he highlighted the need for better corporate governance as a means for improving transparency among banks, which may increase the effectiveness of liquidity requirements.

Other factors that affect the banking industry have been heavily investigated – more specifically, concentration in the banking system, which refers to the exposure of banks to potentially incurring large losses that may threaten their viability or ability to continue operations. Consequently, risk concentration could be on both sides of the balance sheet, in the off-balance-sheet items, in the execution of day-to-day activities, or through a combination of these factors. Accordingly, the concentration exposure of banks can take many forms such as high exposure to an individual counterpart, a group of counterparts, specific industry, services …etc. (Basel Committee of Banking & Supervision , 2012).

Systemic risk increases with a higher degree of bank concentration. Thus, increasing the probability of receiving public support, a more concentrated banking sector would be associated with lower liquidity buffers as it may lower banks' incentives for holding liquidity. For instance, Repullo (2003) used panel data of 57 UK banks (resident) and concluded that strengthening the financial safety net lowers the incentives for banks to hold liquid assets. Also, Aspachs et al. (2005) confirmed these results as they showed that the increased probability of banks receiving lender of last resort support would decrease their liquidity holdings.

Most of these factors contribute to increasing the efficiency of commercial banks, which measures banks' ability to create income from their assets (ECB, 2010). Their performance is considered to have a crucial impact on stakeholders and investors' decisions (Thoraneenitiyan & Avkiran, 2009). However, banking efficiency could be considered an unobserved variable as it is hard to measure due to the intangibility of banks' products and services. The cost to income ratio illustrates firms' ability to generate profits from their revenue sources (ECB, 2010). Several studies that have focused on European countries have

investigated the main factors that impact banks' efficiency, and concluded that the environment and regulations hinder expansion in banks activities. However, these studies found that the regulations improve the cost and profit efficiency of banks (Maudos, et al., 2002; Dietsch & Lozano-Vivas, 2000; Resti, 1997). Please refer to Appendix 3 Table 42, which summarises the main studies that investigated the effects of other factors on liquidity risk among banks in multiple countries.

4.2.3 Linkages between Theories and Empirical Research

The role of the banking system in the economy has spurred the evolution of theoretical frameworks as well as the evolution of empirical research in order to simplify the relationship between the internal, macroeconomic, and regulatory factors then to test these relationships and quantify their impact on banks' liquidity positions and exposures. Theories emerged on how banks manage their assets and liabilities, suggesting various strategies for managing liquidity to ensure the availability of resources (Baumol, 1954). Banks could have enough liquidity through having readily marketable securities that could be converted to cash in normal conditions (Udoka, 2012). The anticipated income theory focused on the importance of timely loan repayments by borrowers as a means for sustaining enough liquidity at banks, which is often associated with risk appetite and banks' willingness to grant loans as banks may suffer from higher loan losses if the increase was due to a shift in credit supply (Keeton, 1999). The decline in long-term interest rates is another factor that could change the risk appetite, which would restructure banks' balance sheets by moving to government securities and decrease their lending exposure to the private sector (Peersman, 2011). This in turn may result in shifting their assets to maximise their profits while ensuring the availability of liquidity in difficult market conditions. These conditions are more

applicable to the shiftability theory were banks shift their assets by selling them to more liquid banks in the secondary market before maturing.

Financing operations through short-term debt may prove to incite more vulnerability at banks if the gap maturity widens between assets and liabilities. For example, Banerjee & Mio (2017) found that banks restructure their assets through increasing their high-quality liquid assets while decreasing their short-term financial loans. These measures are also compatible with the shiftability theory as well as the conservative nature of the banking sector in Jordan, under which its operations are impacted by the cycle of macroeconomic fundamentals. Furthermore, the ability of commercial banks to match their assets and liabilities through restructuring their maturities while ensuring the availability of liquidity for short-term financing at reasonable costs is one of the main factors that contributes to banks' liquidity management. Therefore, funding strategies are determined in parallel with banks' income (Demirgüç-Kunt & Huizinga, 2010), which is why the ladder approach is relied on heavily to structure both sides of banks' balance sheets according to their maturities while setting exposures to maximise banks' profits while retaining enough liquidity.

These actions could insulate banks from negative liquidity shocks. However, if liquidity shortages are considered a widespread phenomenon, many banks will fall short and require the intervention of the central bank as the lender of last resort (Prochnow, 1949). Recently, in the Global Financial Crisis, many large banks faced severe liquidity shortages. Central banks intervened to prevent them from failing through providing them with funding. These cases were investigated through empirical research and found that larger banks usually have lower liquidity targets and have the tendency to rely on the lender of last resort, supporting

the view that regulators will hesitate before closing them (Vodova, 2011; Farhi & Tirole, 2012).

Liability management theory includes the ability of commercial banks to fulfil their liquidity needs by borrowing in the capital and money markets (Alshatti, 2015). This requires banks to match their liquidity sources to their expected needs. However, the importance of balance sheet structure for financial institutions' viability stresses the importance of matching assets and liabilities over set time horizons. Banks need to assess the impact of current and potential market conditions on the predictable maturity behaviour of their assets and liability positions and take whatever steps are necessary to meet unexpected liquidity needs. These theories highlighted many important factors that affect liquidity management and could increase the levels of liquidity risk that may stem from various resources related to day-to day operations with regards to lending and trading activities (Chorafas, 2007). The potential match between both sides of the balance sheet in terms of maturity and the sensitivity to interest rates minimises liquidity and interest rate risks (Zawalinska, 1999; Belete, 2013).

These procedures of preserving liquidity are echoed in the empirical literature as banks are continually seeking to match their assets' maturities with their short-term and medium-term funding resources. Such dependency presents the taxonomy of liquidity risk (Bessis, 2010; Bonfim & Kim, 2012). For example, Banerjee and Mio (2017) concluded that banks which tend to finance their risky activities through short-term debt are vulnerable to liquidity shocks and shortages. Others have concluded that liquidity and credit risk are negatively related as a strong increase of lending activity in relation to the volume of acquired deposits is accompanied by a decrease in credit risk (Wójcik-Mazur & Szajt, 2015). Also, Demirgüç-Kunt and Huizinga's (1999) results suggest that short-term liquidity acquired from

customers' current, savings and time deposits do not have a significant impact on net interest income, although some evidence showed that it may lower profitability. Accordingly, the following section will contain a survey of the empirical literature that investigated the liquidity relationship with several factors.

4.2.4 Liquidity Risk at Commercial Banks in Jordan

Most of the available literature about the Jordanian-banking sector focused on the effect of liquidity on the profitability of the banking sector as only a few researchers investigated the effects of macroeconomic, regulatory and bank-specific factors on liquidity risk. In particular, most studies focused on the effect of bank-specific and macroeconomic environmental factors on banks' profitability. Most of these studies used Ordinary Least Squares (OLS) regression. They found that assets and liabilities have a significant impact on banks' profitability, represented by ROA and ROE (Al Shubiri, 2010; Alzorqan, 2014; Alshatti, 2015). Further, Al Shubiri (2010) stressed the importance of ALM on building a general liquidity strategy for commercial banks in Jordan. The macroeconomic factors were found to have a significant impact on profitability.

Another paper compared liquidity risk management between Jordanian and Saudi banks Almumani (2013) , using a sample of 10 Saudi and 14 Jordanian banks over the period 2007-2011. The results indicate a similarity in the interaction between the bank-specific variables and liquidity risk with the exception of bank size as it had a negative but insignificant relation in the case of Jordanian banks. The comparison between the two banks reveals that the Saudi banking system is more efficient in generating profit due to the efficient management of liquidity, whereas Jordanian banks have a more liquid position, which could hamper profit generation.

The large size of the commercial banks in Jordan compared to other sectors in the economy raise the need for the Jordanian authorities to shield the banking sector from the negative effects of economic crises through improving the efficiency of both sides of banks' balance sheets (CBJ, 2000). Thus, evaluating the performance of banking institutions is an essential requirement to ensure the strength of the banking system, economic stability and growth. The nature and structure of the Jordanian economy leaves most economic sectors more susceptible to exogenous shocks and spill-overs from the global economy as well as its neighbouring countries (CBJ, 2015).

The scant research on liquidity risk in the banking sector in Arab countries as a whole and in Jordan in particular is one of the main drivers of this study. This research will investigate the existing relationships between bank-specific variables, regulatory variables, and macroeconomic variables, and liquidity risk through both descriptive and econometric techniques. This study will help us in identifying relationships that would help to mitigate liquidity risks in Jordan's commercial banks.

4.2.5 Research Gap

Liquidity risk management is one of the core functions of the bank treasury and finance departments. Its effects encompass the individual banking institutions to overall liquidity in the domestic market. The recent developments in the banking industry as well as the increased complexity of the financial markets has highlighted the need for banks to preserve their liquidity positions through focusing on liquidity management and the risks stemming from liquidity positions. Therefore, managing liquidity risks at banks has gained more momentum in recent years, especially in the wake of the Global Financial Crisis and supervisory authorities have implemented financial regulations accordingly.

The surveyed literature has shown that most empirical studies have focused on the effects of liquidity risk management on profitability. However, few studies have focused on the effects of profitability on liquidity risk. Most of the studies surveyed in the literature review showed the existence of a negative relationship between profitability and liquidity risk (Bonner, et al., 2015; Bourke, 1989; Wójcik-Mazur & Szajt, 2015; Demirgüç-Kunt & Huizinga, 2010; Demirgüç-Kunt & Huizinga, 1999; Barth, et al., 2003; Molyneux & Thornton, 1992). Nonetheless, most of these studies were focused on cross-country analysis and their main datasets involved banks in advanced economies.

Moreover, the empirical evidence on the relationship between credit and liquidity risk is mixed as there is no consensus in the theoretical models regarding the dynamics of liquidity and credit risks over time (Imbierowicz & Rauch, 2014). For example, Roman and Sargu (2015) indicated that credit risk is associated with negative bank lending growth. They also indicated that impaired loans have a negative impact on liquidity and that this is a major internal factor for banks. On the other hand, Imbierowicz & Rauch, (2014) investigated the relationship between credit risk and liquidity risk and concluded that there is no economically significant causality between the two. However, the study found that the interaction between liquidity risk and credit risk increases the probability of default among banks, which calls for joint management of liquidity risk and credit risk in banks.

The introduction of new measures and tightened capital adequacy rules in order to ensure banks' viability and achieve financial stability by the Basel committee resulted from the repercussions of the global Financial Crisis (Ben Naceur & Roulet, 2017). Systemic risks were at the heart of the debate with capital ratios, bank size and liquidity management all considered the main determinants of risks within the banking sector. Large banks were at

the centre of these debates as they tend to have lower capital ratios, less stable funding, and more exposure to potentially risky market-based activities (Laeven, et al., 2014). Also, Laeven et al. (2016) found evidence that systemic risk is lower in more-capitalized banks, with the effects particularly more pronounced for large banks. On the other hand, Roulet (2018) found that capital ratios have a significant negative impact on large European retail lending growth and other types of lending over the post-2008 financial crisis period.

The effects of capitalization on banks have gone hand in hand with investigating the effects of size on banks' performance as liquidity risk varies depending on bank size and some studies have focused on the relationship between bank size and performance. Berger and Bouwman (2009) found that the effects of bank size have two different signs depending on the market structure and the regulatory and operational frameworks in each country (Asiri, 2007; Ali, et al., 2011; Belete, 2013; Laurine, 2013). However, Roman and Sargu (2015) found that their effects on overall liquidity are mixed.

Other researchers focused on the effects of size on liquidity buffers, while others argued that larger banks are faced with liquidity risks stemming from various sources, which increases the level of regulation set by the regulatory authorities on these banks (Acharya & Merrouche, 2012). For example, Aspachs et al. (2005), Agénor et al. (2004) and Delechat et al. (2012) concluded that there is a negative effect between liquidity buffers and bank size. Small banks should hoard more liquidity as tapping into the financial markets would be costly compared to larger banks (Kashyap & Stein, 2000), whereas large banks may need lower liquidity holdings as they have easier access to funding with lower costs, which attract investors to protect them from uncertainties and systemic risk (Gatev & Strahan, 2006).

In this chapter, the study will focus on investigating the impact of the main bank specific variables on liquidity risk management in Jordan. This study will focus on analysing the effects of internal factors in a low-income country that is still affected by repercussions from the Global Financial Crisis and the instability in the region due to political struggles in many neighbouring countries. This study will try to close the gaps in the empirical literature with regards to investigating the effects of internal banking factors in a low-income country as most of the empirical literature has focused on advanced and emerging market economies.

Furthermore, this study will control for the effects of the regulatory and macroeconomic environment. Furthermore, the research will study the effect of political instability as the Jordanian economy has been heavily influenced by the geopolitical tensions in the region under the banner of the Arab Spring. Moreover, due to the lack of theoretical foundations for the effects of interactions between credit risks and liquidity risk, this study will investigate these interactions on the liquidity risk in Jordan as most of the surveyed literature investigated these interactions in the US and Europe.

4.3 Research Hypotheses

In the empirical literature review section, the researcher found that internal factors have a major impact on banks' management of their liquidity (Roman & Sargu, 2015; Zaghdoudi & Hakimi, 2017). For example, some researchers indicated that bank-specific factors impact liquidity risk irrespective of the ratios used and the countries under investigation (Wójcik-Mazur & Szajt, 2015). In this section, the study hypotheses will focus on main internal factors.

I. Liquidity Risk and Profitability

Banks with higher profitability ratios may face higher liquidity risks. However, the impact of profitability on liquidity risk management is dependent on the financial model banks operate, which determines the liquidity risk exposures and the desired level of profitability. A higher the share of other income or other funding than deposits could yield a higher bank risk (Demirgüç-Kunt & Huizinga, 2010), where interest margins and bank profitability reflect a variety of determinants related to bank characteristics (Demirgüç-Kunt & Huizinga, 1999).

The results of the empirical research varied on the relationship between profitability and liquidity risk. For example, Molyneux and Thornton (1992) found an inverse significant relationship between profitability and liquidity holdings. Also, Bourke (1989) found a significant positive relationship between liquidity and bank profitability. On the other hand, Barth et al. (2003) found that the structure of supervision had a weak influence on bank performance, and that liquidity ratios had a negative impact on profitability, measured by return on assets (ROA). Kosmidou (2008) found that liquidity ratios are negatively related to return on average assets (ROAA). Demirgüç-Kunt and Huizinga (1999) found that the liquidity ratio negatively affects ROA and positively affects NIM.

Overall, the results in the empirical literature were mixed depending on the sample, time period, and banking sector in the countries under investigation. Accordingly, the researcher could expect that profitability ratios, measured by Return On Average Assets (ROAA) and the Return On Average Equity (ROAE), will have a negative impact on liquidity risk as the increase in profitability is a result of greater exposure due to a rise in risk appetite, riskier assets and a decrease in the quality of the overall assets and liquid assets. On the other hand,

the study could find a positive impact of profitability on liquidity as it increases the confidence of depositors and thereby the liquidity resources available. Furthermore, the researcher expect that the influence of net interest margin (NIM) to be weak due to the effect of regulatory measures set by supervisory authorities depending on the frameworks adopted by commercial banks.

Hypothesis (1): *Commercial banks with high profitability ratios face higher liquidity risk.*

II. Liquidity Risk and Credit Risk

The interest rate structure has a great influence on risk appetite at banks (Peersman, 2011). Accordingly, setting credit risk exposures and monitoring lending activities may have a major impact on liquidity holdings. The impact of credit risk on liquidity risk is positive in most of the surveyed empirical literature (Roman & Sargu, 2015; Acharya & Viswanathan, 2011). Also, Roulet (2018) found that liquidity indicators have positive but perverse effects on bank lending growth. He pointed out that funding structure is an important factor in banks' lending activities as the results indicated that the ratio of available stable funding to total assets (liquidity measure) has an insignificant influence on bank's lending activities. Diamond and Rajan (2005) showed that there is a positive relationship between liquidity risk and credit risk, implying that both increase simultaneously. On the other hand, Wójcik-Mazur and Szajt (2015) found a negative relationship between liquidity measures and credit risk both in the long and short term. However, Imbierowicz and Rauch (2014) concluded that there is no economically meaningful relationship between liquidity risk and credit risk. They indicated that the interaction between liquidity risk and credit risk increases the probability of default among banks, which calls for joint management of these risks in banks.

Based on the above, the researcher expect credit risk, measured by non-performing loans (NPL), to have a positive impact on liquidity risk at Jordanian commercial banks as the relationship will be more elaborate due to the high reliance of banks on their regular operations to incur profits. The increase in the level of NPLs reduces banks' asset quality and their ability to allocate their resources to their operations as they have to take more provisions against NPLs.

Hypothesis (2): *Commercial banks with high non-performing loans face higher liquidity risk.*

III. Liquidity Risk and Bank Size

The empirical literature on banking has heavily investigated the influence of bank size on performance or used bank size as a control variable. The liquidity risks that banks face vary depending on bank size, market structure and the regulatory and operational frameworks in each country (Berger & Bouwman, 2009). Laeven et al. (2016) found strong evidence that systemic risk increases with bank size. Large banks that engage in multiple activities may face governance problems that could yield higher systemic risks (Bolton, et al., 2007).

However, larger banks are faced with different types of liquidity risks than smaller banks as they have an extra task of top-down liquidity provision from the central bank into the banking system (Acharya & Merrouche, 2012). DeYoung and Jang (2016) concluded that larger banks tend to have lower liquidity targets than smaller banks but they manage these targets more efficiently. Similarly, Vodova (2011) found that large banks have lower liquidity targets as they rely on the government and the lender of last resort in the event of shortages. Aspachs et al. (2005), Agénor et al. (2004) and Delechat et al. (2012) concluded that there is a negative effect between liquidity buffers and bank size.

Bonner et al. (2015) found that the relationship between bank liquidity buffers and bank size is substantially weaker in countries with bank liquidity regulations, which implies that liquidity regulations act as a substitute for liquidity management at commercial banks. This result may explain why small banks should hoard more liquidity buffers due to the higher costs of accessing funding (Kashyap & Stein, 2000), whereas large banks may need lower liquidity holdings as they have easier access to funding with lower costs (Gatev & Strahan, 2006). Accordingly, the researcher expect bank size to have positive impact on liquidity as large banks tend to engage in more diverse operations than smaller ones.

Hypothesis (3): *Large commercial banks face higher liquidity risks.*

IV. Liquidity Risk and Capital

Higher capital ratios reduce liquidity risks (Diamond & Rajan, 2000). Basel I & II have focused on bank capital ratios as one of the crucial factors for banking viability and achieving financial stability (Ben Naceur & Roulet, 2017). Laeven et al. (2016) concluded that risks are lower in well-capitalized banks. Banerjee and Mio (2017) found evidence that well-capitalized banks have stronger growth in their balance sheets, accumulate less high-quality liquid assets and exhibit healthier growth in their non-financial sector lending portfolios.

Similarly, Ben Naceur and Roulet (2017) indicated that capital has a positive impact on liquidity ratios. Their findings indicate that banks tend to hold liquidity buffers and increase their holdings of liquid assets when they expand their risky activities to avoid liquidity shortages, and improve their ability to absorb risks. On the other hand, Roulet (2018) found that capital ratios have a negative impact on lending growth and other types of lending over the post-2008 financial crisis period.

Furthermore, the impact of capital adequacy regulations on banks' insolvency and investments as they have an effect on the allocation of funds amongst the firms in the economy (Berger, et al., 2016; Kim & Santomero, 1988). They found that the effects of capital adequacy regulations on financial stability are ambiguous and that systemic risk might increase as a result of imposing capital constraints on banks, although capital adequacy regulations limit banks' credit exposures. They concluded that capital adequacy regulations would lead to a lower risk exposure of the banking system (Eichberger & Summer, 2005).

Therefore, the effect of capital on banks' liquidity included the effects of banking regulations as Basel II focused on capital ratios to impose restrictions that would ensure banks' viability. The study has used several measures for capital in order to capture the effect of capital on liquidity, and the researcher expect that all of these variables will have a positive effect on liquidity.

Hypothesis (4): *Commercial banks with higher capital face lower liquidity risks.*

V. Liquidity Risk and Banking Efficiency

Having better internal factor ratios contributes to increasing the efficiency of commercial banks, which refers to the ability of banks to create revenues from their assets (ECB, 2010). However, banking efficiency could be considered an unobserved variable as it is hard to measure due to the intangibility of banks' products and services. The cost to income ratio illustrates firms' ability to generate profits from their revenue sources (ECB, 2010). Several studies that have focused on European countries have investigated the main factors that impact banks' efficiency, and concluded that the environment and regulations affect several banking ratios that are related to their activities such as capital, lending and liquidity ratios.

However, these studies found that regulations improve the cost and profit efficiency of banks (Maudos, et al., 2002; Dietsch & Lozano-Vivas, 2000; Resti, 1997).

Consequently, the researcher expect the quality of management, measured by the cost to income ratio (CTIR), to have a positive impact on liquidity as higher-quality management would reduce governance problems and result in better allocation of bank resources.

Hypothesis (5): *Commercial banks with higher efficiency face lower liquidity risks.*

4.4 Data and Methodology

4.4.1 Data

The variables employed in the econometric analysis were acquired from the BankScope database and the central bank of Jordan for thirteen banks depending on data availability for the period 2004-2015. The study started from 2004 as it marks the end of the economic and financial reforms in Jordan that were backed by the IMF (CBJ, 2015). These reforms resulted in the liberalization of the financial sector, the adoption of indirect monetary policy to manage liquidity in the domestic market, and the adoption of a fixed exchange rate regime with the Jordanian dinar in late 1995.

The sample population will consist of all operating commercial banks in Jordan. However, due to data limitations, and the existence of Islamic banks, which operate in Jordan, the study will exclude four Islamic banks as their practices, policies, and procedures differ from traditional commercial banks. Thus, the sample will include thirteen commercial banks. The yearly data will cover the period from 2004-2015 for the following commercial banks that operate in Jordan:

Table 25: List of the population in econometric analysis

Bank Name	Date of Establishment
Arab Bank Plc (ARBK)	1930
The Housing Bank for Trade & Finance (THBK)	1974
Jordan Kuwait Bank (JOKB)	1977
Cairo Amman Bank (CABK)	1960
Jordan Ahli Bank Plc (JABK)	1956
Union Bank (UNBK)	1991
Bank of Jordan Plc (BKJO)	1960
Capital Bank of Jordan (CABK)	1996
Arab Jordan Investment Bank (AJIB)	1978
Jordan Commercial Bank (JCBK)	1978
Société Générale de Banque-Jordanie (SGBK)	1993
Arab Banking Corporation (Jordan) (ABCO)	1989
Invest Bank (INBK)	1989

4.4.2 Research philosophy

There are different patterns and methodologies that could be used to coordinate whether testing a theory (deductive) or building one (inductive). Accordingly, dealing with the relationships under investigation and understanding them through investigating these variables individually or collectively and explaining what happens to these variables in the real world. These questions can be answered by taking into consideration the following subjects while understanding the research paradigms of methodology, epistemology and ontology (Bryman & Bell, 2011; Creswell, 2009).

Ontology deals with the relationships that are studied through two main arguments that deal with reality. The first argument is that the phenomena under investigation can be represented by a set of variables that could be studied individually (objectivism). The latter argument suggests that the phenomena could not be separated from individual awareness as the variables are interdependent of each other (constructivism). The first argument backs the positivist approach, which is concerned with scientific evidence that is normally associated with deductive methods. The second argument, which opposes the positivism of natural

science, supports the interpretivist approach where both are commonly associated with inductive methods (Creswell, 2009).

The second paradigm, epistemology, deals with the nature of the association of the researcher with his research. Similarly, there are two main approaches in epistemology; the first approach, positivism, which sees observable evidence as the only form of defensible scientific findings that the researcher could get through neutral scientific procedures and that are not connected to the researcher; or, on the other hand, the second approach, interpretivism, which supports the view that relativism is subjective and differs from person to person, which implies that the researcher and his knowledge are interconnected (Creswell, 2009).

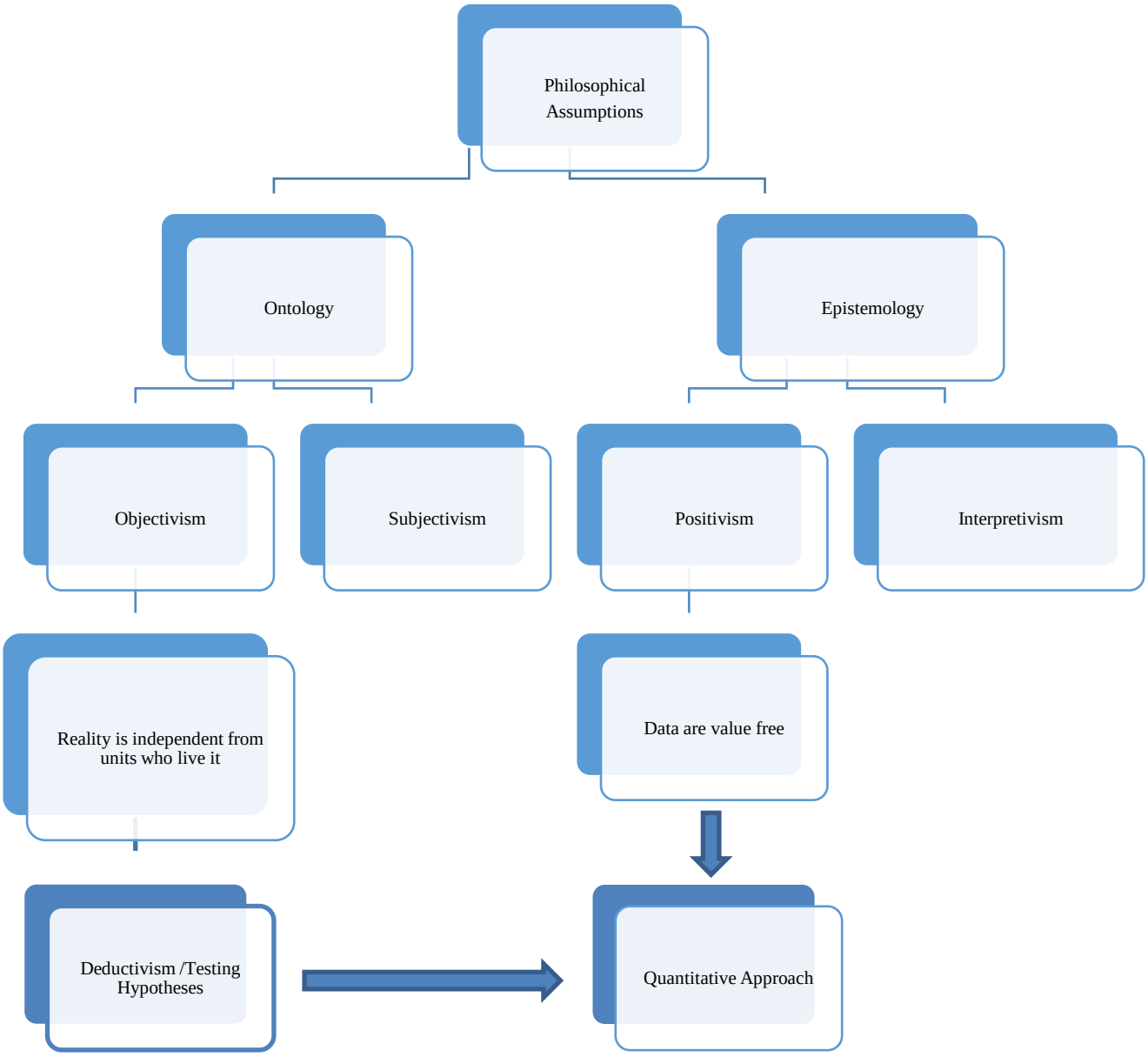
This part of the research will employ a deductive approach to construct and test the research hypotheses. Burrell and Morgan (1979) said that positivism "*seeks to explain and predict what happens in the social world by searching for regularities and causal relationships between its constituent elements*".

Saunders et al. (2012) supported the view that the deduction approach that is concerned with positivism illustrates inter-relations between the variables of the phenomena under investigation and the need to conclude. Additionally, positivist researchers utilize quantitative and statistical analysis to explain their subjects. Neuman (2014) stated that "*researchers prefer precise quantitative data and often use experiments, surveys, and statistics. They seek rigorous, exact measures and objective research and they test hypotheses by carefully analysing numbers from the measures*". In light of the researchers' opinions, the properties of this research require the use of the deductive methods rather than the inductive approach:

- The deductive approach is more organised than the inductive approach and relies on experiments and scientific methods.
- This study will test the hypotheses by investigating the impact of the independent variables and their causality with the independent variables, through collecting related statistics and using statistical and econometric methods.
- The results of the analysis will be more reliable due to the reiteration of the experiments by different researchers. The same results indicate reliable results.
- The results could be generalized to the whole population.
- Quantitative data helps researchers to test hypotheses and answer the research questions; this approach is noticed in most business research.

Accordingly, developing valid and viable hypotheses should take into consideration the impact of these variables on each other (Robson & McCartan, 2016). Consequently, the researcher will test the research hypotheses that were created based on quantitative data and the deductive approach. The following figure summarises the research philosophy and approach employed to achieve the study's aims and objectives:

Figure 27: Research Philosophy Diagram[25]



4.4.2.1 Quantitative and Qualitative methods

There are three main research methods: the quantitative approach, qualitative approach and mixed approaches (Bryman & Bell, 2011). The qualitative approach employs descriptive

[25] The above figure shows that there are two main philosophical assumptions that can be used to conduct business studies. Thus, philosophical assumptions such as ontology and epistemology revealed that when researchers focus on testing hypotheses instead of building a new theory, the deductive approach must be adopted to get valid knowledge. The positivist epistemology paradigm relies on the quantitative approach to get valid knowledge. Furthermore, the positivism paradigm implies that in the case of collecting data externally – "Value Free Data" – the objectivist ontology and positivist epistemology must be used to get an acceptable knowledge. Thus, since this section of my research used secondary data, and these are indirectly obtained from the study population, the positivist and objectivist paradigms are used to these the hypotheses of this research (Walliman, 2017).

and other approaches that are non-numerical in nature to collect information used to explain and interpret a certain phenomenon (Creswell, 2009).

This method is suitable for conducting research on social phenomena in a continuous period so that the researcher can identify changes in preferences and habits. The quantitative approach is usually used when the researcher employs statistical methods to test his hypotheses and make some conclusions than can be generalized. This method can be used in most studies that focus on quantification and measurement to collect and analyse numeric data 'positivist epistemology-deductive' (Bryman & Bell, 2011). However, it is subject to criticism as transparency or reliability can already be low and conclusions and facts may not be generalized (Berg & Lune, 2014). Moreover, this approach needs more time to acquire the needed data and analyse it, which may lead to insufficient conclusions (Berg & Lune, 2014).

Accordingly, to overcome the limitations in this approach, some researchers suggested the use of mixed methods to provide more comprehensive answers to research questions. However, according to Creswell and Plano Clark (2011), the mixed method is suitable when either the qualitative method or quantitative method is not adequate to address the research problem. Despite numerous benefits of the mixed approach, there are some shortcomings. The mixed approach is more costly and needs further time compared to other methods. In addition, some conflicts between the results of the qualitative and the quantitative analysis should be resolved.

The present study does not make use of the qualitative approach for several reasons. First, the main aim of the study is to investigate the impact of liquidity risk on banks' internal factors in Jordanian commercial banks. Therefore, such investigation requires several years

of data to be clearly seen. Second, the researcher will use secondary data sources as it is fairly difficult to access the needed data via interviews. Furthermore, this study will rely on the deductive method, which is based on a theoretical background to develop and test the hypotheses. Third, the use of secondary data facilitates the comparison between the results of this study and previous studies in liquidity risk management. Finally, the process for analysing qualitative data is costly and time-intensive. Therefore, this section of the study will rely on one method to collect data, which is the quantitative method, through the Bank Scope database and the central bank of Jordan.

4.4.3 Method

Panel data is a term that refers to a set of two-dimensional data that contain time series observations and for a cross-sectional number of individuals. (Hsiao, 2007). Data availability is one of the main advantages of employing panel data, however, it is considered more costly than collecting cross-sectional or time series data. Moreover, panel data is widely used in developing countries where they may not have long time series as some of them have only recently started the tradition of collecting statistics. Therefore, panel data has several advantages over cross-sectional or time-series data (Nerlove, 2002; Hsiao, 2003).

The inference of the model would be more accurate using panel data analysis (Hsiao, 2007) as it has more degrees of freedom when compared to times series models and variability in the sample is larger when compared to cross sectional data, therefore improving the efficiency of the estimates. Moreover, the ability of panel data models is more elaborate in having more accurate results through taking into account ;the behavioural element in the data as well as accounting for the impact of variable omission or unobserved variables.

Another important issue for using panel data is the ability to rely on inter-individual differences for reducing collinearity between current and lag variables to estimate unrestricted time-adjustment patterns, as the estimation of time adjustment pattern using time series data relies on arbitrary prior restrictions for models with time lags, which could be highly collinear (Hsiao, 2007). Furthermore, panel data generates more accurate predictions for individual outcomes by pooling the data rather than generating predictions of individual outcomes using the data on the individual in question (Hsiao, 2007).

In this research section, the researcher will use panel data analysis to investigate the impact of internal factors on liquidity risk while controlling for the regulatory and macroeconomic environment. The reason behind that is that analysing liquidity risks on the banking sector through employing time-series analysis would yield results that would be hard to rely on due to the nature of the banking sector.

In Jordan, there are two main types of banks – commercial banks and Islamic banks having different policies and operating processes as Islamic banks tend to comply with Sharia law, while commercial banks rely on interest rates as their main source of income. Moreover, the data available for these factors covers a short period, which will make it difficult to use usual time-series analysis as these methods rely on having restrictions on the model with time lags, which raises the collinearity between the variables.

4.4.3.1 Random / fixed effects models

Panel data is relatively easy to analyse under a set of assumptions to obtain robust regression results. Most econometric analysis is concerned with the impact of explanatory variables on the regression function, which implies that needed to hold the intercept term constant, which represents the unobservable random variable. In this research, the discussions will focus on

whether to treat the unobservable random variable as a fixed or random effect. The intercept term is crucial for panel data analysis. It is usually referred to as an unobserved, time-constant variable and is called an unobserved effect in panel data analysis.

The basic unobserved effects model (UEM) can be written, for a randomly drawn cross-section observation i, as follows:

$$y_{it} = x_{it}\beta + c_i + u_{it}$$

For $t = 1,2,3, \ldots, T$. Also, x_{it} is a vector (*1xk*) that contains observable variables that change across time and through cross-sections (i)… Furthermore, the model contains the unobserved component (c_i) and the idiosyncratic errors that change across time as well as through cross-sections. In empirical research, there are discussions about whether to treat the unobserved component as a random effect or as a fixed effect as it is viewed as a variable that could be estimated. In panel data models, the unobserved component is referred to as a random effect when it is treated as a random variable and a fixed effect when it is treated as a parameter to be estimated for each cross-section.

These discussions about defining the nature of the unobserved component should be determined based on the characteristics of the sample as large random draws from cross-sections would result in the unobserved component being treated as random along with the rest of the dependent and independent variables. This approach neglects the heterogeneity among cross-sections in the panel data. Therefore, determining whether the unobserved component is correlated with the explanatory variables is important for determining this issue. Mundlak's (1978) approach yields important insights for understanding the difference between random

and fixed effect frameworks, and is very useful for testing whether the unobserved component is uncorrelated with the regressors (the critical assumption in a traditional random effects).

Consequently, the researcher can deduct that the random effects framework is synonymous with no correlation between the observed independent variables and the unobserved effect, i.e. $Cov\ (x_{it}, c_i) = 0\ for\ t = 1,2,3, \dots, T$. On the other hand, under a fixed effect framework, treating the unobserved component as non-random means allowing for arbitrary dependence between the unobserved component and the explanatory variables. Practically, the key difference between a fixed effects approach and a correlated random effects approach is that in the former case, the relationship between the unobserved component and the independent variables is left entirely unspecified. Therefore, in the analysis of panel data models, the intercept term, *C*, (Mundlak , 1978) could be referred to as a random effect when the researcher treats it as a random variable and a fixed effect when it is used as a parameter to estimate for each cross-section observation. The main assumption that allows for determining which framework to adopt in panel data analysis is whether the constant term is correlated with the explanatory variables or not. In the random effect framework, zero correlation between the observed explanatory variables and the unobserved effect will be used to justify statistical inference. The fixed effect framework allows for random dependence between the unobserved effect and the observed explanatory variables (Wooldridge, 2010).

In this research, a panel estimation technique is used when the data set combines both time series and cross-sections. The flexibility in modelling differences in behaviour across observation units is the main advantage of a panel data set over a cross-section. The framework used will be as follows:

$$y_{it} = \alpha_i + \beta' x_{it} + \varepsilon_{it} \quad (3)$$

where α_i is an individual effect, which is constant over time (t), and specific to the cross-sectional unit (i). x_{it} represents the regressors and β' represents the correspondent coefficient, and ε_{it} is the error term. Equation (4) represents the general specification for the random and fixed models. Differences across groups are allowed in the fixed effect framework to capture the constant term differences through assuming dependency between the explanatory variable and the constant term. On the other hand, the random effects assume that the unobserved effect is uncorrelated with the regressors (Greene, 2012). The difference between the specification for the fixed model and random effects is the random disturbance (μ) characterizing observation (i) and is constant through time. In random effects specification, it is assumed that individual effects are uncorrelated with the other regressors $E(x_u) = 0$. Thus, the random effects specification could be represented as follows:

$$y_{it} = \alpha_i + \beta' x_{it} + \mu_i + \varepsilon_{it} \quad (4)$$

Testing whether the random or fixed framework is appropriate, the researcher will use the Hausman test, which focuses on testing whether the unobserved effect is not correlated with the explanatory variables. If the study rejects the null hypothesis, then the researcher should rely on using the fixed effect model as it would be more appropriate. In the case of having a large population, the random effect would be more appropriate to use, whereas the fixed effects framework would be more appropriate is the study focusing on a set of specific units (Baltagi, 1995).

The researcher will employ bank-level data to investigate the effects of bank-specific factors over the period 2004 to 2015. In addition, the researcher will estimate the impact of liquidity risk for the commercial banks using the loan to deposits ratio (LTD) and liquid assets to total assets ratio (LQATA), and some bank-specific variables while controlling for the influence of regulatory and macroeconomic factors. The latter is a linear equation that has the following:

$$LR_{it} = \alpha_{it} + \sum_{k=1}^{5} \gamma_{itk} x_{itk} + \sum_{j=1}^{3} \beta_{itj} y_{itj} + \varepsilon_{it} \qquad (5)$$

where (LR) represents the liquidity risk at bank (*i*) during time (*t*). In addition (x_{itk}) represents the vectors for the banks' characteristics while y_{itj} represents controlling for macroeconomic and regulatory influence. Also, (α, γ, β) are intercept terms and the regressors' coefficients. The control variables are bank characteristics for bank *i* in period t−1. The list of control variables for bank characteristics and activities used in this study are M2 to GDP, inter-bank interest rates, and the required reserves ratio. The study wanted to control for these dimensions of development as it are focusing on internal factors on liquidity risk. The following section will include a detailed description of the variables used in the analysis.

4.4.4 Variables Definitions

The selected variables include the banking-specific characteristics and will include profitability, quality of management, size, credit risk, and capital. The study will use three ratios as a proxy for profitability in the commercial banks, namely return on average assets (ROAA), return on average equity (ROAE), and net interest margin (NIM). The quality of management was proxied by using cost to income ratio (CTIR); the size of the bank was estimated using the size of bank assets to total banking assets. As for credit risk and capital, the researcher will use non-performing loans to total assets (LOLTA), tier 1 regulatory capital

(TIER1), the total capital ratio (TCR), and equity to total assets (EQTA). The definition of all variables used in the econometric analysis is illustrated in Table 28.

4.4.4.1 Liquidity risk variables

ALM emerged to express the need to manage both assets and liabilities simultaneously in order for banks to mitigate against various risks and maximise their operating income. Liquidity risk stems from various resources that are related to day-to day operations with regards to lending and trading activities (Chorafas, 2007). Thus, the study used the loan to deposits ratio (LTD), and high liquid assets to total assets ratio (LQATA) as a proxy for liquidity risk as the ALCO monitors actual cash flows against its projections to determine the effect of transitory or permanent changes in loans and deposits that affect balance sheet positions and take proper actions. In addition, they focus on managing the maturities of the banks' asset with the objective of covering cash flows from matured assets to meet liquidity needs (Koch, et al., 1999; Al Shubiri, 2010; Alzorqan, 2014; Alshatti, 2015).

Liquidity risk: As most bank risks are considered unobserved, researchers have tried to proxy its levels using financial ratios. As banks in Jordan are more conventional in nature, the study has used the **loan to deposits ratio (LTD)** and **liquid assets to total assets (LQATA)** (Bourke, 1989; Molyneux & Thornton, 1992; Barth, et al., 2003; Dezfouli, et al., 2014; Bonner, et al., 2015; Roulet, 2018). The **loan to deposits ratio (LTD)**[26] is a widely used measure for liquidity at banks. It is percentage of total loans to total deposits. This ratio expresses the level of long-term liquidity that covers banks' credit. If the ratio is high, it signals that the banks would not have sufficient funds to cover their funding needs. Conversely, if the ratio is too low, the bank

26 BankScope defines the loan to deposit ratio as gross loans to deposits and short-term funding.

may not be earning as much as it could be. Furthermore, **liquid assets to total assets (LQATA)**[27] is considered an important indicator that can be used in managing liquidity and assessing if the bank has enough liquid assets. If a bank has a low ratio, it means that it could face liquidity problems as it does not have enough liquidity to meet its needs.

Consequently, researchers have tried to use various measures as a proxy for liquidity risk. For example, Bai et al. (2018) used the liquidity mismatch index (LMI), which evaluates a bank's liquidity based on its asset and liability structure through using measures for market and funding liquidity mismatches between the market liquidity of assets and funding liquidity for liabilities to predict the probability of a bank crash during the Global Financial Crisis. Also, it could be used as a macro-prudential liquidity indicator as it could be aggregated across banks unlike the Basel III liquidity measures (LCR, NSFR). Furthermore, the UK Financial Services Authority (FSA) introduced a new quantitative liquidity measure known as Individual Liquidity Guidance (ILG), which is a similar design to the LCR established by the Basel committee. Following the global agreement on LCR, ILG was superseded by LCR (Banerjee & Mio, 2017). Other researchers have used various liquidity ratio measures (Dezfouli, et al., 2014; Wójcik-Mazur & Szajt, 2015) and have used the ratio of cash assets to total assets and net loans and total deposits to measure liquidity risk, respectively. Table 26 summarizes some liquidity measures used in other empirical research.

27 According to BankScope, liquid assets include cash and due from banks, trading securities at fair value through income, loans and advances to banks, reverse repos and cash collaterals.

Table 26: Some liquidity measures used in empirical research

Author(s)/ Year	Liquidity risk Measure
(Bourke, 1989)	The ratio of liquid assets to total assets
(Molyneux & Thornton, 1992)	The ratio of liquid assets to total assets
(Demirgüç-Kunt & Huizinga, 1999)	The ratio of loans to total assets
(Barth, et al., 2003)	The ratio of liquid assets to total assets
(Kosmidou, 2008)	The ratio of net loans to customer and short term funding
(Dezfouli, et al., 2014)	The ratio of cash assets to total assets
(Wójcik-Mazur & Szajt, 2015)	Net loans and total deposits
(Banerjee & Mio, 2017)	Individual Liquidity Guidance (ILG)
(Bai, et al., 2018)	Liquidity Mismatch Index (LMI)

4.4.4.2 Bank-specific Variables

The focus of choosing the bank performance variables is to estimate the impact of bank-specific metrics on liquidity risks that pertain to profitability, capital adequacy, credit risk and quality management. The data for these variables was acquired directly from the BankScope database. **Profitability:** In the literature, profitability effects on liquidity are mixed. To investigate these effects, this study will use several profitability variables that are used by researchers (Demirgüç-Kunt & Huizinga, 1999; Staikouras & Wood, 2004; Demirgüç-Kunt & Huizinga, 2010; Sufian, 2011; Al-Jafari & Alchami, 2014; Pagratis, et al., 2017). **Return on average assets (ROAA):** A widely used indicator for tracking the profitability and scale of the financial performance of banks. ROAA is calculated by taking net income and dividing it by average total assets. **Return on average equity (ROAE):** Another measure of profitability that is computed by dividing net income by average shareholders' equity. **Net interest margin (NIM):** Another measure of profitability from the banks' core functions. This is calculated by taking the difference between interest income on assets and interest expense on liabilities to

average earning assets. This ratio resembles a bank's ability to make good investment decisions.

Capital: Absorbing more bank risks with higher capital buffers (Berger & Bouwman, 2009), the implementation of the Basel accords I & II increased investigations of introduced capital rules, the role of capital in banking performance, and lending activities. Accordingly, this study will employ several measures for capital in order to capture the effect of capital on liquidity at commercial banks (Vodov, 2013; Bonner, et al., 2015; Roman & Sargu, 2015; Laeven, et al., 2016; Kim & Sohn, 2017). **Total capital ratio (TCR):** Refers to bank capital (including tier one and tier two) to risk-weighted assets. It is used to assess a bank's ability to protect depositors and is a measure of a bank capital. **Tier 1 regulatory capital (TIER 1):** Refers to a bank's core capital to its risk-weighted assets. This ratio measure a bank's financial strength. **Equity to total assets (EQTA):** Represents the amount of assets that shareholders could claim. It is measured by dividing total shareholders' equity to total assets. It is used to assess the financial health of a bank and financial leverage.

Bank size: Banking industry market share is important to consumers and investors alike. It represents the size of a bank's operations and the market structure. In this study, the researcher has calculated market share by taking the natural log of the total assets of each bank (Delechat, et al., 2012; Acharya & Merrouche, 2012; Roman & Sargu, 2015; DeYoung & Jang, 2016).

Credit risk: The effects of credit risk on liquidity risk vary in the literature depending on heterogeneous banks' characteristics and behaviour. Diamond and Rajan (2005) showed that there is a positive relationship between liquidity risk and credit risk. Roman and Sargu, (2015) indicated that impaired loans have a negative impact on liquidity, while Roulet (2018) found that liquidity indicators have positive but perverse effects on bank lending growth.

The study considered using **non-performing loans to total assets (LOLTA)**, which is an indicator that can be calculated by dividing non-performing loan value by total assets using as a measure to proxy credit risk and increases in this ratio illustrate that a bank is more prone to the probability of customers defaulting.

Quality of management: The capability of a bank to create revenues from an asset that it bears, reflecting the management quality of the bank, which is considered an important metric for investors and clients (Thoraneenitiyan & Avkiran, 2009). The study considered using the cost to income ratio (CTIR) (Maudos, et al., 2002; Dietsch & Lozano-Vivas, 2000; Resti, 1997), which is considered as a measure of the management quality of a bank. A lower ratio indicates that a bank is profitable and has high management quality. It is calculated by dividing operating expenses by operating income. Table 27 summarizes some liquidity measures used in the empirical research.

Table 27 : Some bank internal factor measures used in empirical research

Author(s)/ Year	Bank specific metrics
(Demirgüç-Kunt & Huizinga, 1999; Pagratis, et al., 2017; Staikouras & Wood, 2004)	Profitability
(Vodov, 2013; Bonner, et al., 2015; Roman & Sargu, 2015; Laeven, et al., 2016; Kim & Sohn, 2017)	Capital
Delechat, et al., 2012; Acharya & Merrouche, 2012; Roman & Sargu, 2015; DeYoung & Jang, 2016	Bank Size
(Diamond & Rajan, 2005; Roman & Sargu, 2015; Roulet, 2018)	Credit Risk
(Maudos, et al., 2002; Dietsch & Lozano-Vivas, 2000; Resti, 1997)	Quality of Management

4.4.4.3 Choice of Control variables

Regulatory measures by supervisory authorities affect bank operations and exposures. The main focus of banks' regulatory bodies is to safeguard banks through setting benchmarks that are focused on mitigating their risk exposure. The Basel committee has focused on regulations related to capital, concentrated activities, and liquidity management in banks as most of the recent financial crises have been caused by insolvency and liquidity shortages that were played out on the wholesale funding markets. Naceur and Kandil (2009) show that further regulations should be implemented in order to strengthen the stability of the financial system following the Global Financial Crisis. Also, Banerjee and Mio (2017) did not find any evidence to suggest that tightening liquidity regulations would shrink banks' balance sheets, nor reduce the amount of lending to the non-financial sector. Moreover, Pagratis et al. (2017) used US banks' quarterly data from 2002 up to the Global Financial Crisis (Q1 2002 to Q1 2009). They found through multiple stress scenarios that the intervention of the government is a predominant factor that allowed US banks to honour their maturity transformation role during the Global Financial Crisis.

Several researchers have focused on the role of capital adequacy regulations in commercial banks, as they are a standardized measure put in place by regulators for banks and other depository institutions to determine how much liquidity is required to be held for a certain level of assets. For example, Laurine (2013) studied the determinants of liquidity risk in Zimbabwe and found that the capital adequacy ratio (CAR) and required reserve ratio (RRR) have a negative impact on liquidity risk, and recommended that banks should focus on bank capitalization and interest rate spread. Thus, monetary authorities' regulations could mitigate liquidity risks in the banking system through managing liquidity buffers as banks

often tend to expect to receive funding from their central bank in the case of a shortage (Aspachs, et al., 2005).

Other researchers have studied the impact of capital adequacy regulations on banks' insolvency and aggregate investment as they have an effect on the allocation of funds amongst firms in the economy (Berger, et al., 2016; Kim & Santomero, 1988). They found that the effects of capital adequacy regulations on financial stability are ambiguous and that systemic risk might increase as a result of imposing capital constraints on banks, although capital adequacy regulations limit banks' credit exposures. They concluded that capital adequacy regulations would lead to a lower risk exposure within the banking system (Eichberger & Summer, 2005).

Ben Naceur and Roulet (2017) used a data sample of 23 countries[28], mostly developed, over the period 2008–2015. They concluded that capital regulatory ratios have had a significant negative impact on US banks' credit growth. In contrast, capital ratios do not have a significant impact on European banks' credit growth. However, capital regulatory measures have a significant negative impact on European banks' credit growth. Also, liquidity, as measured by the non-required amount of stable funding to total assets, has a significant positive impact on US and European banks' credit activities.

These findings suggest that banks in the study sample hold buffer stocks of liquid assets to expand their risky activities to avoid liquidity shortages when facing tighter market conditions and to improve their ability to absorb risks. Furthermore, Laeven et al. (2016)

[28] Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

studied the systemic risk of large banks during the recent financial crisis to identify bank-specific factors that determine risk using a sample of 412 deposit-taking institutions from 56 countries. They illustrated that inadequate capital explains systemic risk better than bank funding or operating activities, underpinning the Basel method of mitigating systemic risks through capital regulations rather than activity constraints.

Moreover, the effects of monetary policy tools have been investigated by researchers. For instance, Kashyap and Stein (2000) used a large data sample for US commercial banks from 1976 to 1993 to trace the effects of monetary policy on the lending behaviour of individual banks. They found that the impact of monetary policy on lending is stronger for banks with lower liquidity ratios (less liquid balance sheets). Also, they concluded that changes in monetary policy matters are greater for the lending of those banks with the least liquid balance sheets and confirmed the existence of the lending channel of monetary transition mechanism. Furthermore, Wójcik-Mazur and Szajt (2015) found that increased overnight interest rates encourage the intensification of banks' engagement in the money market. In addition, Kim and Sohn (2017) found that federal funds' effective rate had a positive significant impact on lending activities, which may imply the pro-cyclicality of monetary policy as hikes in interest rates appear at the peak of the economic cycle but rates then decline when the economy is facing exogenous shocks.

On the other hand, the macroeconomic environment has been highlighted in empirical research as the macroeconomic environment conditions have an effect on banks' performance and activities. The empirical literature has accounted for macroeconomic variables to capture the effect of economic conditions in a country on banks' performance indicators, but the results were mixed and were subject to debate due to the endogeneity

between the macroeconomic environment and banks' activities. Some researchers illustrated that the macroeconomic variables were found to have a significant positive impact on bank performance (Ali, et al., 2011; Athanasoglou, et al., 2008), while others concluded that the variables have a negative impact (Belete, 2013).

Favourable economic conditions would impact positively on the supply and demand of commercial banking services. Thus, macroeconomic variables, which are considered one of the determinants of profitability and ALM strategy planning, will depend on the cyclicality of economic conditions in a country (Belete, 2013; Ali, et al., 2011). Moreover, Singh and Sharma (2016) investigated the effects of monetary policies and the business cycle on liquidity risk. They found that monetary policies and business cycles have a negative impact on excess liquidity and bank liquidity. Also, they found that the unemployment rate adversely affects demand for loans. Also, Zaghdoudi and Hakimi (2017) indicated that macroeconomic factors have different impacts on liquidity. They found that GDP has a positive impact whereas inflation rates have a negative impact on liquidity.

Other studies have found that cyclicality in macroeconomic variables is one of the factors that affects volatility in ALM policies. Also, they found some evidence that ALM policy tends to resist the economic cycle which may induce some attention in planning and forecasting different scenarios of their operational effectiveness as the higher risks involved might cause higher losses (Novickytė & Petraitytė, 2014). Aspachs et al. (2005) highlighted the effects of the economic cycle on liquidity in the banking system using a sample of 57 resident banks in the UK for the period 1985-2003. They suggested that banks appear to build up their liquidity buffers during economic downturns and draw them down in economic upturns. Moreover, Ben Moussa (2015) stressed the importance of the

macroeconomic effect on liquidity which was validated by Wójcik-Mazur and Szajt (2015) as they found the existence of a positive dependency relationship between GDP growth and liquidity risk.

Kim and Sohn (2017) used a quarterly sample for US commercial banks for the period 1993-2010 to examine the effects of banks' capital on lending activities. Their results indicated that the effect of the economic environment, measured by GDP growth, is positive but more pronounced at larger banks. As for smaller banks, the macroeconomic effect was negligible and negative, which suggests that larger banks' operations tend to be in tandem with the cyclicality of the GDP. Vodov's (2013) results showed that a macroeconomic factor (GDP) has an ambiguous effect on the liquidity of commercial banks. However, macroeconomic factors' effects on liquidity depend on the macroeconomic environment (Roman & Sargu, 2015).

Table 28: List of dependent and independent variables

Dependent variable			
Name	**Symbol**	**Formula / Definition**	**Data Source**
Loan to Deposit	LTD	Loan / deposit	Bankscope
Liquid Assets To Total Assets	LQATA	Liquid assets / total assets	Bankscope
Independent variables			
Bank specific variables			
Name	**Symbol**	**Formula / Definition**	**Data Source**
Profitability Ratio			
Return On Average Assets	ROAA	Net income / average total assets	Bankscope
Return On Average Equity	ROAE	Net income / average total equity	Bankscope
Net Interest Margin	NIM	Interest income - interest paid out	Bankscope
Capital Ratio			
Total Capital Ratio	TCR	Total capital / risk-weighted assets (RWAs)	Bankscope

Tier 1 Regulatory Capital	TEIR1	Equity plus retained earnings to risk-weighted assets	Bankscope
Equity to Total Assets	EQTA	Equity / total assets	Bankscope
Credit risk , bank size and Quality Management ratios			
Cost To Income Ratio	CTIR	Operating expenses/operating income	Bankscope
Market Share, size	MARS	Natural log of total assets	Bankscope
Non-Performing Loans to Total Assets	LOLTA	Total loans where payments have not been made for a period of 90 days / total assets	Bankscope

Control variables			
Regulatory variables			
Required Reserve Ratio	RRR	Portion of depositors' balances that banks must have on hand as cash.	Central bank of Jordan
Inter-bank interest rate	IBR	The rate of interest on short-term loans between banks.	Central bank of Jordan
Macroeconomic variables			
M2 to GDP	MGDP	The ratio of broad money supply to GDP.	Central bank of Jordan

Accordingly, in this study, the researcher will include three control variables: The **Required Reserve Ratio (RRR)**, which is a requirement determined by a country's central bank, in order to capture the impact of mandatory liquidity buffers on liquidity. It is the stipulated portion of the customer's deposits that banks must have on hand or in cash. Also, the **Inter-Bank Interest Rate (IBR)**, which is the rate of interest charged on short-term loans made between banks, and is included to capture the effects of monetary policy on banks as it is considered the operational target for the central bank. For capturing the effects of the macroeconomic environment, the study will use money supply **(M2) to GDP** (financial deepening index), which is a complex concept that expresses long-term economic growth. Many studies were in favour of the relationship between economic growth and money supply (Edward, 1973; Pradhan, 2009; McKinnon, 2010), which is considered a prime requirement for economic growth and a measure of the financial deepening of the economy.

Accordingly, the specification for the empirical models can be illustrated as follows:

$$LTD/LQATA_{it} = \alpha_{it} + ROAA_{it} + TCR_{it} + MARS_{it} + CTIR_{it} + LOLTA_{it} + \sum_{j=1}^{3} \beta_{itj} y_{itj} + \varepsilon_{it} \quad (6)$$

$$LTD/LQATA_{it} = \alpha_{it} + NIM_{it} + TCR_{it} + MARS_{it} + CTIR_{it} + LOLTA_{it} + \sum_{j=1}^{3} \beta_{itj} y_{itj} + \varepsilon_{it} \quad (7)$$

$$LTD/LQATA_{it} = \alpha_{it} + ROAE_{it} + TCR_{it} + MARS_{it} + CTIR_{it} + LOLTA_{it} + \sum_{j=1}^{3} \beta_{itj} y_{itj} + \varepsilon_{it} \quad (8)$$

$$LTD/LQATA_{it} = \alpha_{it} + ROAA_{it} + TEIR1_{it} + MARS_{it} + CTIR_{it} + LOLTA_{it} + \sum_{j=1}^{3} \beta_{itj} y_{itj} + \varepsilon_{it} \quad (9)$$

$$LTD/LQATA_{it} = \alpha_{it} + NIM_{it} + TIER1_{it} + MARS_{it} + CTIR_{it} + LOLTA_{it} + \sum_{j=1}^{3} \beta_{itj} y_{itj} + \varepsilon_{it} \quad (10)$$

$$LTD/LQATA_{it} = \alpha_{it} + ROAE_{it} + TIER1_{it} + MARS_{it} + CTIR_{it} + LOLTA_{it} + \sum_{j=1}^{3} \beta_{itj} y_{itj} + \varepsilon_{it} \quad (11)$$

$$LTD/LQATA_{it} = \alpha_{it} + ROAA_{it} + EQTA_{it} + MARS_{it} + CTIR_{it} + LOLTA_{it} + \sum_{j=1}^{3} \beta_{itj} y_{itj} + \varepsilon_{it} \quad (12)$$

$$LTD/LQATA_{it} = \alpha_{it} + NIM_{it} + EQTA_{it} + MARS_{it} + CTIR_{it} + LOLTA_{it} + \sum_{j=1}^{3} \beta_{itj} y_{itj} + \varepsilon_{it} \quad (13)$$

$$LTD/LQATA_{it} = \alpha_{it} + ROAE_{it} + EQTA_{it} + MARS_{it} + CTIR_{it} + LOLTA_{it} + \sum_{j=1}^{3} \beta_{itj} y_{itj} + \varepsilon_{it} \quad (14)$$

Where LTD and LQATA are the dependent variables, which represent the loan to deposit ratio and high-quality liquid assets. On the right-hand side, the researcher used three variables to proxy profitability: return on average assets (ROAA), return on average equity (ROAE), and net interest margin (NIM). In addition, the researcher used Tier 1 regulatory capital (TIER1), total capital ratio (TCR), and equity to total assets (EQTA). Moreover, the researcher introduces quality of management proxied using cost to income ratio (CTIR). The size of the bank was estimated using the size of bank assets (MARS). As for credit risk, the researcher will use non-performing loans to total assets (LOLTA). The use of different variables as a proxy for profitability is that the ROAA and ROAE are often used in literature

to capture operating efficiency and the ability of commercial banks to generate revenues from various investments, whereas the net interest margins are more related to the core banking duties – namely taking deposits and lending credit. Furthermore, the study has used different variables to estimate the impact of capital on liquidity, as there are regulatory factors that are related to capital that could influence its impact on liquidity.

4.4.5 Data Characteristics

Before running the analysis, the researcher check the appropriateness of the data and the model through various tests in order to ensure that the underlying assumptions have not been violated and to thereby confirm that the findings of the study can be generalised. More details about these assumptions – namely, outliers, normality, multicollinearity, heteroscedasticity, autocorrelation – will be discussed in the next section. Descriptive statistics for all 13 banks are analysed to identify any mistyped or missing values, incomplete information, or extreme values. These values will be used to determine the existence of extreme abnormal values in the data as they tend to increase the error variance and affect the results of the analysis. One of the most common ways to check for these values is comparing the deviations of the observations from the mean ± 3 standard deviation.

Dealing with the problem of outliers to have more reliable characteristics of the data statistical properties could be done through Winsorization. This is a method used to remove outliers in data by removing observations that are considered outliers on the higher ends of the distribution. A possible advantage of Winsorizing is that it preserves the information that a case had among the highest (or lowest) values in a distribution, but protects against some of the harmful effects of outliers. Furthermore, the researcher will apply normality testing on the panel dataset in order to check whether the data follows a normal distribution.

4.4.5.1 Data screening and post estimation tests

Before running the analysis, the researcher must take a quick glance at the study main statistical data properties. The study final dataset consists of 2,184 bank-year observations and the descriptive statistics results show the original data, the Winsorized data at the 1st and 99th percentiles, 5th and 95th percentiles, and 10th and 90th percentiles, respectively. The following section will contain the descriptive statistics and data screening results. The descriptive statistics for bank performance indicators illustrated in Table 29 show divergent trends in their profitability, size, capital, and quality of management.

Table 29: Descriptive statistics

Variable	Mean	SD	Min	Max	Skew.	Kurt.
Liquidity Risk						
LTD	4.09	0.21	3.48	4.65	0.1	3.1
LQATA	3.21	0.41	2.09	4.21	-0.3	2.7
Profitability Ratio						
NIM	3.78	0.87	1.44	5.43	-1.1	4.4
ROAA	0.32	0.58	-2.22	1.75	-1.8	9.6
ROAE	2.31	0.61	-0.45	3.93	-1.9	10.6
Capital Ratio						
TIER1	1.04	0.09	0.84	1.27	0.5	2.9
TCR	2.89	0.25	2.36	3.61	0.6	3.0
EQTA	14.17	2.93	6.48	21.96	-0.4	3.0
Credit risk & Quality Management Ratios						
MARS	7.66	1.09	5.41	10.51	1.1	4.4
CTIR	45.93	11.82	13.34	105.31	-0.9	6.4
LOLTA	0.82	0.57	-0.77	3.19	0.1	4.7
Control Variables						
RRR	1.59	0.14	1.36	1.96	1.2	5.1
M2GDP	11.75	4.39	3.76	20.08	-0.8	3.6
IBR	1.25	0.35	0.67	1.87	0.0	1.9

This table reports the summary statistics of the annual data for the commercial banks sample in Jordan during the period 2004-2015. The results are shown for the mean and standard deviation, skewness, and kurtosis for the data before Winsorization.

The results are reported after taking the natural log for data transformation, except for bank size (MARS), which is proxied through taking the natural log of each bank's total assets, to smooth the variability of data while capturing its behaviour. The raw data shows that most of the variables do not follow a normal distribution due to the existence of outliers, which could

be explained by taking a look at Jordanian banking sector structure as there is high concentration of assets and liabilities amongst certain banks compared to the rest of the sample, which could explain the existence of outliers in the sample as well as the heterogeneity among cross-sections. Therefore, to deal with the problem of outliers and make the data more reliable, Winsorization is used. The results, presented in Table 30, indicate that most of the outliers in the data were in the 90th percentile as observable changes in the mean of the data set and the standard deviation can be shown in the winsorized data at the 90th percentile. Some of the variable means increased after Winsorization while others decreased, showing that outliers were at both ends of the distributions. Removing those outliers deduced the standard deviation of the variables.

Table 30: Descriptive statistics after Winzorization

Variable	Mean	Median	Max	Min	Std. Dev.	Skew.	Kurt.	J-B	Prob.
Liquidity Risk									
LQATA_C	3.2	3.3	4.1	2.3	0.4	-0.1	2.4	2.4	0.30
LTD_C	4.1	4.1	4.5	3.7	0.2	0.1	2.5	1.8	0.40
Profitability Ratio									
ROAA_C	0.4	0.4	1.5	-1.8	0.4	-1.4	9.4	319.3	0.00
ROAE_C	2.3	2.4	3.5	0.3	0.4	-1.0	7.2	142.4	0.00
NIM_C	3.8	3.8	5.4	1.7	0.8	-0.3	2.6	4.1	0.13
Capital Ratio									
TIER1_C	1.0	1.0	1.2	0.9	0.1	0.3	2.5	4.5	0.11
TCR_C	2.9	2.8	3.4	2.5	0.2	0.5	2.6	6.2	0.05
EQTA_C	14.1	14.2	19.3	8.3	2.6	0.0	2.1	5.3	0.07
Credit risk & Quality Management ratios									
MARS_C	7.6	7.6	9.3	5.7	0.8	0.3	2.6	3.3	0.19
CTIR_C	45.7	45.1	67.0	19.4	10.0	-0.2	2.6	2.6	0.27
LOLTA_C	0.8	0.8	2.2	-0.4	0.5	0.0	3.5	1.4	0.50
Control variables									
IBR_C	1.2	1.2	1.9	0.7	0.4	0.0	1.9	7.5	0.02
RRR_C	1.6	1.6	2.0	1.4	0.1	1.1	4.9	56.5	0.00
M2GDP_C	11.8	11.2	20.1	3.8	4.4	0.2	2.4	3.0	0.22

The table reports the summary statistics of the annual data for the commercial banks sample in Jordan during the period 2004-2015. The results are shown for the mean and standard deviation, skewness, kurtosis, and J-B normality test for the Winsorized data at the 90th percentile.

After removing the outliers, the data for the 90th percentile (Winsorized) indicated that some of the variables were still not following normal distribution, indicating a high

heterogeneity between cross-section groups. However, the dependent (LTD, LQATA) variables were normal as the J-B test results indicated that the study accept the null hypothesis. As for the explanatory variables, the J-B test indicated that they (ROAA, ROAE, IBR, RRR) do not follow a normal distribution as the study has rejected the null hypothesis that the data follows a normal distribution. In addition, the rest of the variables were normally distributed at the 90^{th} percentile (Winsorized). Therefore, the assumption of normality for some variables in the dataset is not met. However, while meeting the condition is desirable for reasons of estimator performance, it is not essential for either the random or fixed effects approaches for panel data (Clarke, et al., 2010).

Moreover, Table 36 illustrates the correlation matrix between the variables. The matrix shows that (LTD) has a relatively weak positive correlation with (LOLTA, IBR, EQTA, CTIR, M2GDP, NIM, ROAA, RRR), whereas it has a negative weak correlation with (MARS, ROAE, TCR, TIER1). On the other hand, the dependent variable (LQATA) has a relatively strong positive correlation with M2GDP (54.2%) and a relatively weak positive correlation with (LOLTA, IBR, ROAA, ROAE, TCR, TIER1) and a weak negative correlation with (EQTA, CTIR, MARS, NIM, RRR). Therefore, most of the variables do not exhibit high correlation between each other.

However, some profitability variables (ROAA, ROAE, NIM) and capital variables (TIER1, TCR, EQTA) have some high correlation between each other. For example, ROAA has a very strong positive correlation with ROAE (93.2%). In addition, TCR has a very strong positive correlation with TIER1 (96.9%) and EQTA has a strong positive correlation with TCR and TIER1 (54.8% and 57.4%). On the other hand, NIM has a relatively weak positive correlation with ROAA and ROAE (25.8% and 21.0%). In order to resolve the issue of high correlation

between the independent variables, namely ROAA, ROAE, NIM and TIER1, TCR, EQTA, the researcher split those variables in the estimation through having 18 models to capture the effects of those variables on liquidity risk and to consolidate the results by having more than one variable to proxy the effects of profitability and capital on liquidity risk – see Appendix 4.

4.4.5.1.1 Normality test

The Jarque-Bera test is a goodness-of-fit test of whether sample data have the skewness and kurtosis matching a normal distribution. It is considered one of the most widely used methods for testing whether the distribution underlying a sample is normal (Bowman & Shenton, 1975; Bera & Jarque, 1982; Jarque & Bera, 1987). It is defined as follows:

$$JB = n\left[\frac{S^2}{6} + \frac{(C-3)^2}{24}\right] \quad (1)$$

where *S* is the skewness, *C* is the kurtosis, and *n* is the number of observations. The JB test was derived by Bera and Jarque as the Lagrangian Multiplier (LM) test against Pearson family distributions. It has an asymptotic chi-square distribution with two degrees of freedom. The JB test is simple to compute and its power has proved comparable to other powerful tests. The results are shown in the table below. Normality test results indicated that most of the variables follow normal distribution at the 90th percentile except for EQTA, ROAA, ROAE, IBR and RRR.

Table 31: Normality test

Variable	Adj. Chi ^{2}			
	Original data	**99th%ile**	**95th%ile**	**90th%ile**
		Liquidity Risk		
LTD	0.32	0.32	0.32	2.34
LQATA	2.20	2.20	2.20	3.54
		Profitability Ratio		
NIM	4.37	4.37	4.37	4.40
ROAA	58.54***	58.54***	58.54***	47.5***
ROAE	61.51***	61.51***	61.51***	32.73***

Capital Ratio				
TIER1	4.15	4.15	4.15	5.43*
TCR	8.15**	8.15**	8.15**	5.91*
EQTA	2.14	2.14	2.14	13.55***
Credit risk & Quality Management ratios				
MARS	15.06***	15.06***	15.06***	3.49
CTIR	18.87***	18.87***	18.87***	2.97
LOLTA	9.06**	9.06**	9.06**	1.72
Control variables				
IBR	27.03***	27.03***	27.03***	27.03***
RRR	27.11***	27.11***	27.11***	27.11***
M2GDP	4.21	4.21	4.21	4.21

This table reports the results of the normality tests for the variables in the study. The results are shown for the data before Winsorization – Winsorized data at the 1st and 99th percentiles, 5th and 95th percentiles and 10th and 90th percentiles, respectively. The asterisk signs refer to the significance of the variables: * Significant at 10% ** Significant at 5% *** Significant at 1%, respectively.

4.4.5.1.2 Unit Root Test

The analysis of panel data is focused more on cross-section analysis. The data sets are usually short and wide. Therefore, heterogeneity across groups is essential and could be considered as the main focus of the analysis (Greene, 2012). Panel data econometrics has been equipped with various investigative tools. One of the tools that have been developed is panel data unit root tests. The concepts involved in testing for unit roots in panel data are very much analogous to the time-series case. From an inferential point of view, treating a non-stationary regressor as if it were stationary will give very misleading and at worst nonsensical results. A variable is termed non-stationary if it contains a unit root. Such variables need to be differenced once or more to obtain a stationary variable. One of the weaknesses of many of the recent tests for unit roots in panel data was the reliance on the unrealistic assumption of cross-sectional independence.

In empirical applications, this assumption was often seen to be violated. Hence there has emerged a growing literature on panel unit root tests with cross-sectional dependence. Many unit root tests have been proposed for use with panel data (Levin & Lin, 1992; Levin & Lin, 1993; Levin, et al., 2002; Im, et al., 2003). Unit root testing in time series differences is that

the study is taking into account the asymptotic behaviour between the cross-sections (N) and the times series (T). The way in which N and T converge to infinity is critical if one wants to determine the asymptotic behaviour of estimators and tests used for non-stationary panels. Also, the main difference between unit root tests is the level of restriction imposed on coefficients' heterogeneity and the inclusion / exclusion of deterministic terms. The researcher will briefly discuss the most common unit root test used for panel data, namely Levin-Lin-Chu Test and Im, Pesaran and Shin Test. Furthermore, cross-sectional dependence testing will be employed as in panel data, cross-sectional dependency can significantly affect the inference about slope parameters.

The power of a test is the probability of rejecting the null when it is false and the null hypothesis is the unit root. Most panel unit root tests use the following general form:

$$\Delta y_{it} = \rho_i y_{it-1} + \sum_{l=1}^{p_i} \phi_{i,l} \Delta y_{i,t-l} + \alpha_i d_{it} + \varepsilon_{it} \qquad (2)$$

where y is the variable that is needed to be tested, and d_{it} is the deterministic component. If ρ_i = 0, this means that the y process has a unit root for individual i, while $\rho_i < 0$ means that the process is stationary around the deterministic part. The testing procedures almost uniformly allow the short-run dynamics (the lag polynomial in $\Delta y_{i,t-l}$) to differ among individuals, not just in coefficients but also in the number of lags (p_i). Because differing values of p_i mean different samples, the testing procedures need to allow for unbalanced samples. Furthermore, the coefficients on deterministic variables and the variance of ε_{it} are also allowed to vary, which means that most of the inputs of the general form will be heterogeneous.

Levin et al. (2002) proposed a test which allows for individual specific effects as well as dynamic heterogeneity across groups, and requires that $N/T \to 0$, as the cross-sectional dimension (*N*) and the time series dimension (*T*) tend to infinity. This test is considered to perform well when (*N*) lies between 10 and 250 and when (*T*) lies between 5 and 250. However, one disadvantage of the test statistic is that it relies critically on the assumption of cross-sectional independence (Breitung, 2000). Moreover, Im et al. (2003) suggested the use of the mean of individual unit root statistics for dynamic heterogenous panels. The test uses a standardized T-bar statistic, which is built on the Augmented Dicky Fuller statistics averaged across the groups. This statistical method (under general settings) converges in probability to a standard normal variate sequentially with (*T*, *N*) tend to infinity. In this study, the researcher will focus on Levin, Lin and Chu test (2002) as it is more appropriate for panel data with finite and small (*N*, *T*) dimensions. The results are illustrated for the Winsorized data at the 90th percentile in Table 32.

Table 32: Unit Root Test Results

Variable	Level			1st Difference			Result
	None	Intercept	Intercept & Trend	None	Intercept	Intercept & Trend	
Levin, Lin & Chu Unit root test (Common unit root process)							
LTD	0.565	-3.175***	-4.877***	-9.331***	-6.742***	-7.100***	I(0)
LQATA	-4.265***	-2.182**	-0.577	-7.016***	-2.818***	-3.444***	I(0)
ROAA	-5.630***	-7.516***	-3.979***	-9.477***	-0.005	1.565	I(0)
ROAE	-4.233***	-9.659***	-2.949***	-8.678***	-1.911**	-0.980	I(0)
NIM	0.168	-1.767**	-1.487*	-8.606***	-2.125**	-0.816	I(0)
TCR	-0.573	-1.626**	-28.326***	-11.972***	-30.643***	-24.967***	I(0)
TEIR1	-0.143	-3.094***	-31.821***	12.950***	-25.728***	-21.319***	I(0)
EQTA	0.436	-1.033	-16.363***	-11.774***	-19.530***	-15.425***	I(0)
CTIR	1.339	-0.153	-1.532*	-10.901***	-1.165***	-3.167***	I(1)
MARS	5.034	-2.823***	-4.227***	-5.660***	-3.821***	-2.211**	I(0)
LOLTA	-4.493***	-2.545***	-1.348*	-6.358***	-1.999**	-1.638*	I(0)
RRR	0.721	-1.361*	-0.769	-7.931***	-3.255***	-1.756**	I(1)
IBR	-5.127***	-1.835**	-7.240***	-10.297***	-4.259***	-1.794**	I(0)
M2GDP	-6.346***	-3.427***	-0.668	-13.151***	10.878***	14.096***	I(0)
Im, Pesaran, Shin Unit root test (Individual unit root process)							
LTD	-----	-1.51*	-1.858**	-----	-4.259***	-1.034	I(0)
LQATA	-----	1.036	2.025	-----	-2.611***	-0.897	I(1)

ROAA	-----	-4.393***	-1.351*	-----	-3.681***	-1.159	I(0)
ROAE	-----	-4.905***	-0.334	-----	-2.939***	-1.136	I(0)
NIM	-----	-0.161	0.522	-----	-2.744***	-0.343	I(1)
TCR	-----	-0.308	-6.209***	-----	-8.701***	-4.004***	I(0)
TEIR1	-----	-0.969	-7.149***	-----	-7.953***	-3.919***	I(0)
EQTA	-----	-0.777	-4.711***	-----	-6.865***	-3.091***	I(0)
CTIR	-----	-1.571*	-1.491*	-----	-4.138***	-1.469***	I(1)
MARS	-----	-1.206	-0.370	-----	-2.051**	-0.325	I(1)
LOLTA	-----	-0.549	0.229	-----	-1.055	0.785	I(2)
RRR	-----	-1.736**	0.116	-----	-1.035	1.095	I(0)
IBR	-----	-2.997***	-4.701***	-----	-3.368***	-0.344	I(0)
M2GDP	-----	0.579	0.344	-----	-8.088***	-4.511***	I(1)

This table reports the results of the unit root test for the LLC and IPS test for the winsorized data at the 90th percentile. The asterisk signs refer to the significance of the variables: * Significant at 10% ** Significant at 5% *** Significant at 1%, respectively.

The above table shows that the researcher used the panel unit root tests from Levin, Lin and Chu (2002) (LLC) and Im, Pesaran and Shin (2003) (IPS) to test whether the data are non-stationary in a panel context. The Levin, Lin and Chu (2002) test assumes a common root process whereas the Im, Pesaran and Shin (2003) test assumes an individual unit root process. Common unit root can be defined as an AR structure for the series under consideration. In contrast, the individual root allows for having a different AR structure in the same series (Barbieri, 2009).

The reported results in the following table indicate that the dependent variable (*LTD*) is stationary at the level in both tests whereas (LQATA) is stationary at the first difference using the IPS test and stationary at the level using the LLC test, which indicates that allowing for different AR coefficients in each series. The results were compatible with the assumptions of the IPS test that allows for differences across groups and different AR structures converge to an equilibrium point with the same speed making this test less restrictive when compared to LLC test (Barbieri, 2009). Most of the variables were stationary except for RRR and CTIR whereas NIM, MARS and M2GDP were stationary at I(I) and LOLTA was stationary at I(2).

4.4.5.1.3 Multicollinearity

Data characteristics often lead to biases in regressions. One of the important issues that researchers should deal with is multicollinearity, which refers to a high degree of correlation between two or more predictors where actions should be taken into account to have reliable estimates of the impact of independent variables on the dependent variable. There are two common methods to investigate this issue: correlation matrices and variance inflation factor (VIF), which could be expressed according to the following formula:

$$VIF = 1/(1 - R_i^2)$$

where R_i^2 is the regression of predictors (i=1, 2, 3…..p) against all remaining independent variables. The accepted ratio of VIF has been a subject of debate in literature. Some researchers have expressed that a value of 10 is the maximum accepted level (Hair, et al., 1995). However, maximum values of 5 (Rogerson, 2001) and 4 (Pan & Jackson, 2008) have also been argued. However, when VIF reach a threshold, they attempt to reduce collinearity through omitting variables using Ridge Regression for data analysis, or through constructing an index to combine those variables. Values of the VIF do not discount regression results, call for the need of variable omissions or suggest the use of ridge regression (O'brien, 2007). Furthermore, serial correlation in residuals should be tested; it occurs when one observation's error term (ε_i) is correlated with another observation's error term (ε_i):Corr (ε_i , ε_i) ≠ 0, thus the study will suffer from the autocorrelation.

4.4.5.1.4 Serial Correlation

Serial correlation, or autocorrelation, often appear in panel data sets error terms as the influence of an error term in a certain period affects the latter error term. One of the main panel data assumptions for linear regressions is that data are not serially correlated. However, if the error term was serially correlated, the estimators will be consistent but will not be unbiased and

efficient. The main reason for this issue is the omission of an explanatory variable that has a significant impact on the dependent variable (Baltagi, 2005).

Detecting serial correlation can be done by employing Wooldridge tests for serial correlation in the idiosyncratic error term in a panel data model as the test has good power properties with samples of moderate size (Wooldridge, 2002). The null hypothesis in this test is that there is no serial correlation.

4.4.5.1.5 Heteroscedasticity

Considering an estimation as best linear unbiased estimator, the researcher should test for the existence of heteroskedasticity. There is more than one test that can be used to do so. In this research, the researcher will employ the Breusch-Pagan heteroskedasticity test. These tests measure the level of disturbances in regressions that their variances are not constant across the sample set (Greene, 2012) through testing for the existence of conditional heteroskedasticity through detecting changes in variances throughout the observation. The estimation of the F in the BP test can be done through the following equation:

$$\hat{u}^2 = \beta_0 + \beta_1 \chi + v$$

where $\hat{u}$ is the squared residual and χ are the independent variables. The BP test investigates (nR^2) with the number of explanatory variables (K). R refers to the squared residual regression of the dependent variable. The test employs the variance of the residual to measure the dependency on the observations of the explanatory variables. The existence of heteroskedasticity results in inefficient estimations (Baltagi, 2005). The null hypothesis in the BP test is that residuals are homoscedastic.

Accordingly, rejecting the null hypothesis means the existence of heteroskedasticity. Researchers have suggested the use of weighted OLS to solve this problem; however, most researchers prefer the use of heteroskedasticity-robust standard errors (Stock & Watson, 2003). In this study, employing the second method if the BP confirmed the existence of heteroskedasticity in the OLS regression models where liquidity risk, represented by *LTD* and *LQATA*, is the dependent variable. The test was used to determine whether the variance in the residuals was constant; the null hypothesis is that residuals are homoscedastic. The researcher will use Robust Standard Errors to resolve the heteroskedasticity issue and increase the efficiency of the estimation.

4.5 Empirical Results

This study has used quantitative analysis in order to estimate the impact of internal factors on liquidity risk measures for the period 2004-2015 for domestic commercial banks in Jordan. The researcher has used three variables that express profitability (*ROAA, ROAE, NIM*) and the same for capital (*TIER1, TCR, EQTA*).

The main reason behind this approach is that profitability measures usually express different meanings depending on the indicator. For example, *ROAA* is often associated with *ROAE*, a widely used indicator that expresses profitability, assessing banks' efficiency managing their revenues and expenses and their ability to generate profits from their financial assets. On the other hand, the *NIM* expresses the net revenues from banks' core functions regardless of fees, which are considered as another element in the bank income statement, as it succinctly summarizes the effectiveness of banks' interest-bearing assets.

Moreover, banks' capital is subject to different regulations set by the supervisory authorities in accordance with Basel regulations to ensure the stability of the banking sector. These

regulations may influence the expected impact of capital on liquidity risk, therefore, different sets of variables were used to estimate the impact of capital on liquidity risk. Furthermore, the study had investigated the impact of these variables while controlling for the regulatory and macroeconomic environment through using three econometric techniques and reporting their results in order to investigate whether the unobserved component is equal or varies through cross-section by using random and fixed effects. In addition, the study used OLS regression to test the properties of the data and to authenticate the results that the researcher received from the adopted model based on the Hausman test.

The following section will present the empirical results of the estimated models for the two dependent variables used to proxy liquidity risk (*LTD, LQATA*). The researcher has estimated the impact of internal variables on liquidity risk while controlling for regulatory and macroeconomic variables. The estimation for several models was employed to resolve the high correlation between variables that are used to proxy profitability and capital and to consolidate the results on the impact of these variables on liquidity risk.

The main advantage of a panel data set over a cross-section is that it permits greater flexibility in modelling differences in behaviour across observation units. Differences across groups are allowed in the fixed effect framework to capture the constant term differences through assuming dependency between the explanatory variable and the constant term. On the other hand, the random effects assume that the unobserved effect is uncorrelated with the regressors (Greene, 2012). Testing whether the random or fixed framework is appropriate, the study will use the Hausman test, which focuses on testing whether the unobserved effect is not correlated with the explanatory variables. If the study rejects the null hypothesis, then the researcher should rely on using the fixed effect model as it would be more appropriate. Accordingly, the

study has bank-level data to investigate the effects of internal factors over the period 2004 to 2015 while controlling for regulatory and macroeconomic effects.

4.5.1 Loan to Deposit ratio (LTD) analysis

The following table illustrates the results from the models where *LTD* is the dependent variable. Taking a quick glance at the results, they indicate that whether the unobserved component is fixed amongst cross-sections or varies is inconclusive. The results may be in part due to employing the capital variables, which are influenced by the regulatory measures to which banks are subjected to ensuring their stability. As for the analysis of the results for the explanatory variables, the researcher has grouped some of these variables based on their definitions. In the empirical estimation, the study has used OLS, random, and fixed-effects models to estimate the impact of various internal factors on liquidity risk. This analysis will compare the results of different models, though most of the results have the same sign in the three methods.

Table 33: Empirical results about the impact of internal variables on liquidity risk /LTD

Dependent Variable (LTD)	Model 1 RE	Model 2 FE	Model 3 RE	Model 4 FE	Model 5 FE	Model 6 RE	Model 7 FE	Model 8 FE	Model 9 RE
Profitability Ratio									
ROAA	0.109*** (0.031)	0.117*** (0.031)	0.058* (0.031)	-----	-----	-----	-----	-----	-----
ROAE	-----	-----	-----	0.033 (0.025)	0.039 (0.024)	0.055** (0.026)	-----	-----	-----
NIM	-----	-----	-----	-----	-----	-----	0.169*** (0.014)	0.168*** (0.015)	0.139*** (0.013)
Capital Ratio									
TCR	-0.033 (0.079)	-----	-----	0.042 (0.039)	-----	-----	-0.028 (0.047)	-----	-----
TIER1	-----	0.174 (0.170)	-----	-----	0.268** (0.135)	-----	-----	0.038 (0.127)	-----
EQTA	-----	-----	0.026*** (0.005)	-----	-----	0.030*** (0.006)	-----	-----	0.017*** (0.005)
Credit risk & Quality Management Ratios									
CTIR	0.004** (0.001)	0.003** (0.005)	0.004*** (0.001)	0.001 (0.001)	0.001 (0.000)	0.004*** (0.001)	0.086** (0.001)	0.003*** (0.000)	0.003** (0.001)
MARS	-0.098*** (0.036)	-0.024 (0.047)	-0.067** (0.034)	-0.037 (0.031)	-0.034 (0.032)	-0.068*** (0.019)	0.005 (0.035)	-0.079** (-0.079)	-0.088*** (0.028)
LOLTA	0.030 (0.029)	-0.011 (0.024)	0.038 (0.027)	0.004 (0.023)	0.007 (0.023)	0.039 (0.029)	0.099** (0.015)	0.008 (0.016)	0.021 (0.018)
Control Variables									
RRR	0.393*** (0.056)	0.295*** (0.070)	0.222** (0.087)	0.293*** (0.038)	0.285*** (0.034)	0.225*** (0.059)	0.113*** (0.038)	0.095*** (0.037)	0.079* (0.044)
IBR	0.082** (0.034)	0.071*** (0.025)	0.059* (0.032)	0.092*** (0.027)	0.086*** (0.026)	0.062*** (0.019)	-0.002 (0.018)	0.111*** (0.017)	0.086*** (0.021)
M2GDP	-0.004 (0.003)	-0.004 (0.002)	-0.000 (0.003)	-0.003 (0.001)	-0.003* (0.001)	-0.001 (0.002)	0.039** (0.001)	-0.002 (0.001)	-0.001 (0.002)
DARS	0.082** (0.035)	-0.085** (0.031)	0.048 (0.033)	0.090** (0.027)	0.091*** (0.026)	0.050** (0.023)	0.003*** (0.015)	0.039** (0.016)	0.015 (0.019)
Constant	3.966*** (0.407)	3.342*** (0.411)	3.528*** (0.278)	3.522*** (0.291)	3.331*** (0.337)	3.363*** (0.172)	3.733*** (0.392)	3.566*** (0.390)	3.611*** (0.204)
R2	0.234	0.703	0.349	0.674	0.671	0.347	0.818	0.818	0.529
F-statistic	4.955***	15.142***	8.717***	13.194***	13.071***	8.641***	28.668***	28.709***	18.266***
No. Obs.	156	156	156	156	156	156	156	156	156

This table presents the results of the analysis of the econometric models that were mentioned in the methodology section. The analysis is done for the period 2004 to 2015. The dependent variable in these models was the loan to deposits ratio (LTD) whereas the internal factors include ratios for profitability, capital, size, non-performing loans and cost to income ratio. The selection of the models between random and fixed effects was based on the results of the Hausman test. Standard errors in the parentheses are the white robust standard errors. The asterisk signs refer to the significance of the variables: * Significant at 10% ** Significant at 5% *** Significant at 1%.

4.5.1.1 Profitability

In commercial banking in Jordan, banks usually depend on lending as their main source of income as interest revenues constitute about 60% of the total revenues for the banking sector. In the first three models, profitability as expressed by ROAA was statistically significant at a 99% confidence level in the first two models and at 90% in the third. An increase of one unit in the ROAA would result in an increase of liquidity risk, measured by LTD, of (0.058 to 0.109). Thus, an increase in the ROAA would result in LTD increasing by a marginally small amount. In the next three models, ROAE was found to be significant at 95% in the sixth model with a relatively smaller impact on LTD than ROAA, i.e. an increase on the ROAE by one unit would result in an increase in liquidity risk by 0.055. In addition, the NIM was significant at 99% confidence level at all models, with a higher impact than ROAA and ROAE. An increase in the NIM by one unit would result in an increase in liquidity risk between (0.139 to 0.169). The results for these variables in the OLS models and the random effects models were the same, indicating a negative impact of profitability on liquidity, which has a positive relationship with liquidity risk; therefore, the researcher can deduct that profitability has a positive impact on liquidity risk in all of the above models.

These results are in line with the nature and characteristics of the Jordanian banking sector, which relies on traditional banking roles as its main source of income. The results (see Table 33) state that profitability, measured by ROAA, has a positive impact on *LTD*, which is used as a proxy for liquidity risk, indicating that an increase in the ROAA at Jordanian banks would result in an increase in liquidity risk. In addition, ROAE has a positive but insignificant impact on liquidity risk measured by LTD, stressing the same results that the study got earlier. Moreover, the NIM impact on liquidity risk was positive and significant at a 99% confidence level in the last three models.

The results suggest that NIM, which is used to express the ability of the bank to generate net revenues from their core functions (extending credit and accept deposits from their counterparts), has a higher and significant impact on liquidity risk, measured by LTD, compared to the impact of ROAA and ROAE, which include the revenues generated from fees and charges. This is consistent with the fact that the conservative nature of commercial banks in Jordan and the low complexity of the financial market in which they operate leads to the conclusion that banks' lending growth will be highly associated with liquidity risk as it has a direct impact on NIM. In addition, the results implicitly indicate that an increase in interest expenses that results from the rise in liquidity acquired from deposits has a negative impact on liquidity risk, measured by LTD. Therefore, an increase in banks' risk appetite would result in an increase in their credit exposures and affect the structure of their balance sheets through decreasing the level of liquid assets held by commercial banks at the expense of liquid assets. Striving to maximise profits through reducing the amount of liquid assets that is available would impact bank operations exposure, which would result in high risk exposure through increased credit lending.

Also, these results indicate the Jordanian banks have limited capacity in accessing liquidity resources through deposits of wholesale funding, thus influencing liquidity risk positively. These results were consistent with Wójcik-Mazur and Szajt (2015), whom reported a positive relationship between liquidity risk and interest rate margin ratio, which was attributed to the impact of lending activities of commercial banks on the margin increase. The reason behind that is the level of lending activity; greater credit growth may result in a significant increase in NIM. Pagratis et al. (2017) attributed the positive impact to banks' ability to access wholesale funding due to their size, which implies that small banks aim for higher interest rate margins

compared to larger banks due to their higher dependence on net interest income as a main factor that constitutes the majority of their profits.

The results came in line with the researcher expectations in the hypothesis section. As banks in Jordan rely mainly on traditional banking as their main source of revenue, maximising their profit would result in higher exposure to liquidity risk. Therefore, banks in Jordan should pay more attention to their market exposures due to its negative impact on liquidity; thus their liquidity risk would increase if they adopted more aggressive policies. The results that the researcher got are backed by the findings of some articles in the literature, which stated that an increase in profitability would impact liquidity negatively, therefore increasing banks' exposure to liquidity risk and heightening their need to search for additional funding resources (e.g., Barth et al., 2003; Kosmidou, 2008; Demirgüç-Kunt & Huizinga, 1999; Sufian & Chong, 2008; Wójcik-Mazur & Szajt, 2015; Pagratis et. al, 2017).

4.5.1.2 Capital

The measures of capital that are referred to in the models are widely used in empirical research. TIER1 is equity capital and disclosed reserves that are divided by risk-weighted assets. TIER1 is considered a measure of banks' strength and is one of the measures implemented by banks and supervised by regulatory authorities in accordance with the Basel regulations. It is a measure of the bank's core capital.

Similarly, the TCR measures a bank's capital in relation to the risk taken through weighting its assets. The idea behind these two measures is to ensure a bank has enough capital to cover the risk taken through its lending activities. Around 50% of TCR comprise TIER1. Furthermore, EQTA is a measure of the percentage of banks' assets funded by private equity. The higher the ratio, the less debt the bank uses to acquire assets. It signifies that investors believe that the

bank is worth investing in. In addition, it is cheaper to finance through equity, which entails less debt-servicing costs.

The results of the models show that TCR does not have a significant impact on liquidity risk, measured by LTD, in all of the models. In addition, TIER1 has a significant positive impact on LTD, which is a proxy for liquidity risk at a 95% confidence level only in the fifth model. An increase of one unit in TIER1 variable will result in an increase of 0.268, indicating that TIER1 capital has a positive impact on LTD, which has a positive relationship with liquidity risk. Therefore, the researcher can deduct that TIER1 ratio has a positive impact on liquidity risk, therefore, regulatory authorities should take into consideration the level of liquidity in the banking system and the management framework of liquidity management at commercial banks before setting Tier 1 ratios and identify their components.

The EQTA has a positive and significant impact on LTD at a 99% confidence level. An increase of one unit in EQTA would result in an increase in LTD of 0.017 to 0.03, indicating a positive impact of EQTA on liquidity risk. The results of the OLS and random effects models indicate that the TCR and the TIER1 variables mostly have an insignificant negative impact on liquidity risk while EQTA has a positive significant impact in all of the models.

The models show that TIER1 has the highest positive impact on LTD, whereas the EQTA impact was positive in all of the models. The results show the influence of regulatory frameworks that are set by supervisory authorities in accordance with Basel requirements, which is around 8% of risk-weighted assets. In addition, banks are required to have liquidity buffers in order to cover the operational risks that arise from their day-to-day operations.

An increase in TIER1, which includes generated profits, is associated with higher liquidity risk, which implicitly shows that variations in TIER1 are largely associated with changes in the profits generated by banks as most of the paid-in capital, required and optional reserves are stable. Therefore, the researcher can deduct that an increase in TIER1 capital that results from a rise in profits would increase the liquidity risks faced by banks. Moreover, banks with adequate liquidity buffers would insulate the impact of capital on liquidity risk. In addition, the results indicate that a higher capital structure could impact liquidity risk positively through the relationship between a bank's capital structure and its lending activities if it has sufficient liquidity buffers.

The impact of capital frameworks that are set by central banks requires banks to relate the amount of high quality capital to cover their risky operations through having a minimum requirement. This would result in TIER1 being a factor that is responsive to changes in risk-weighted assets depending on banks' risk appetite, the expansion of their activities, and the quality of their assets. These results can be related to the commercial banks in Jordan where most of the components on the equity side are stable with the exception of retained earnings, which are impacted by the level of profits generated each year.

The findings of the empirical estimation were counter-intuitive to the researcher expectations in the hypothesis section. The researcher has expected that banks with higher capital ratios be exposed to lower liquidity risk levels. However, the analysis clearly shows that it has a positive impact on liquidity risk. The main reason for this is that well-capitalized banks tends to have lower liquidity targets, which is consistent with the results of Banerjee and Mio (2017), who found evidence that stronger banks with higher capitalization ratios have lower liquidity targets. Moreover, the nature of the banking system and its reliance on lending as a main source

of income and on private funding for capitalization means that its tends to employ available resources to maximise profits. Moreover, Ben Naceur and Roulet (2017) indicated that capital has a positive impact of liquidity ratios.

4.5.1.3 Bank Size

The researcher has used the natural log of the total assets for Jordanian commercial banks in Jordan, which is an asset-based measure, in order to estimate the impact of bank size on liquidity risk. The results in the above models were mostly significant at a 95% confidence level and had a negative impact on LTD, thus negatively influencing liquidity risk. An increase of the bank size by one unit would result in an increase of (-0.067 to -0.098), emphasizing the negative impact of the bank size on liquidity risk. These results were also similar in the OLS and random effects model.

This demonstrated that bank size has a negative impact on liquidity risk as larger banks tend to have different operations as well as their core banking business. Large banks will also attract more clients and increase their liquid assets and deposit base through their market power competitions. Moreover, the large bank will more attractive to big corporates as a safeguard (storage) of their money that will enhance the liquidity position of the large bank and minimize liquidity risks. In addition, the distribution of larger banks' branch networks in Jordan play a vital role in accepting deposits from all clients. The results in the LTD models were counterintuitive to the researcher expectations in the hypothesis section that banks with higher size, measured by the total assets of each individual bank, tend to face higher liquidity risk as the researcher expected larger banks to require higher liquidity allocations. The results of the study analysis are backed up by some conclusions from the empirical literature (Aspachs et al.

2005; Agénor et al. 2004; Delechat et al. 2012; Kashyap & Stein, 2000; Gatev & Strahan, 2006).

4.5.1.4 Credit

The findings of the model showed that there is an insignificant relationship between LTD and non-performing loans except for the seventh model where the impact was significant at 95% confidence level. An increase in credit risk, which is represented by non-preforming loans (LOLTA), would result in an increase in LTD by 0.099, positively impacting liquidity risk. In addition, it is worth noting that LOLTA was only significant in the seventh model and has a fairly small impact on LTD. The results were similar between the OLS, random and fixed effects models. The findings indicate that a deterioration in asset quality would result in an increase in the liquidity risks faced by banks. Indeed, if banks started to expand their credit operations within the domestic market regardless of the quality of the assets that are acquired, this would result in an increase in the level of non-performing loans at banks and the loss provisions that are taken to cover these losses. This in turn would result in a deterioration in banks' liquidity levels and impact their risk appetite negatively, thus increasing the costs borne.

Risk appetite could be considered a crucial factor that impacts liquidity risk as it is directly related to credit risk and bank lending behaviour. Setting credit risk exposures and the need for continued monitoring of lending activities has a positive impact on liquidity risk. The findings of the analysis are backed up by the empirical literature (Acharya and Viswanathan, 2011; Ejoh et al., 2014; Roman and Sargu, 2015, Wójcik-Mazur and Szajt, 2015; Roulet, 2018), implying a positive impact between liquidity risk and lending activities.

It is worth noting that non-performing loans were only significant in one model. The reason behind these results could be explained through the existence of regulatory measures that were

set by the central bank and adopted by commercial banks in Jordan, influencing the impact of non-performing loans on liquidity. Furthermore, there is another influence from the impact of credit risk on liquidity risk through interest rate structure, which is determined indirectly through the monetary policy adopted by the central banks. An increase in interest rates in the market will incentivise the risk appetite of commercial banks, increasing their lending activities to maximise profits.

These results illustrate the importance of setting credit risk exposures within commercial banks while taking into consideration the desired levels of liquidity holdings to mitigate against the impact of liquidity risk. Relating those findings to commercial banks in Jordan highlights the importance of having good asset quality as Jordanian banks depend on their traditional market roles as a major source for generating revenues and maximising their profits.

The findings of the empirical model were aligned with the researcher expectations in the hypothesis section that an increase in credit risk, measured by non-performing loans, would positively impact the liquidity risk faced by Jordanian commercial banks, which is also consistent with most of the surveyed empirical literature (Roulet, 2018; Roman & Sargu, 2015; Acharya & Viswanathan, 2011). This shows that there is a positive relationship between liquidity risk and credit risks, implying that liquidity risk and credit risk increase in a simultaneous manner.

4.5.1.5 Management Efficiency

The findings of the models indicate that CTIR, which is used as a proxy for the quality of management in the analysis, signals a bank's ability to generate more profits from revenue sources through minimizing costs. The CTIR has a positive impact on LTD at a 95% confidence level in most of the models. An increase in CTIR by one unit, which is used as a

proxy for quality of management, would result in an increase of LTD by (0.003 to 0.086), implying a fairly small negative impact between the quality of management and liquidity risk. An increase in the level of CTIR could be attributed to lower efficiency to manage risks by management, which would result in a higher liquidity risk being faced by the banks. The results were also similar in the OLS, random, and fixed effects models but mostly insignificant in the OLS model. The findings indicate a small impact of the quality of management on liquidity risk.

The results could be explained by the impact of the quality of management on banks' costs, which usually decline when management are more efficient at allocating resources more efficiently, therefore minimizing banks' costs and increasing their revenues. This is related to cost management, which emphasizes maximising revenue per unit of cost. The quality of management is an unobserved variable that is hard to estimate due to the intangibility of its products and services.

These results are strongly related to the environment under which Jordanian banks operate. The cost to income ratio (CTIR) is considered an important factor as it is closely linked to the core functions of banks due to the nature of activities of domestic banks that are mainly linked to extending credit to various institutions. Therefore, the study could view this ratio in Jordan as the average revenue per unit cost for credit facilities because the majority of revenues for domestic commercial banks comes from interest payments, which indicate that more efficient management for resources would result in an increase in revenues per unit cost, which results in a decline in the liquidity risks faced by banks.

The results were in tandem with the researcher initial assessment in the hypothesis section that commercial banks with higher efficiency face lower liquidity risks. Moreover, these results

were consistent with the evidence in the empirical literature that having better quality management decreases firm exposure to liquidity risk (Maudos, et al., 2002; Dietsch & Lozano-Vivas, 2000; Resti, 1997; ECB, 2010).

4.5.1.6 Control Variables

Control variables, which are regulatory variables, have been statistically significant in most of the models in Table 33. The reported results were also similar to the OLS, random and fixed-effects models. More importantly, the analysis shows that regulatory control variables had a significant and positive impact on liquidity risk, with LTD as a proxy having a positive impact on liquidity risk. These results could be explained through the impact of higher required reserves from the central bank, which decreases the amount of available liquidity. Moreover, higher interest rates could increase exposure to liquidity risk as it increases the costs borne by banks to secure available funding from the market.

Furthermore, the macroeconomic environment control variable was statistically insignificant in most of the reported models in Table 33. This indicates that the regulatory measures set by the central bank play a crucial role in insulating the impact of the macroeconomic cycles as well on the commercial banks in Jordan. Nevertheless, the dummy variable, which represents the impact of the Arab Spring that started in 2010, had a positive impact on liquidity risk, proxied by LTD, indicating that Jordanian banks have been impacted negatively by their macroeconomic environment as it decreased their ability to collect funding through deposits as well as expanding their credit exposure in the market due to the difficult external conditions. These results, especially for the regulatory variables, were backed by various findings in the empirical literature (Laurine, 2013; Berger et al., 2016; Kim & Santomero, 1988; Eichberger & Summer, 2005; Ben Naceur and Roulet 2017; Laeven et al. 2016).

4.5.2 Liquid Assets to Total Assets ratio (LQATA) analysis

Table 34 illustrate the results from the models where *LQATA* is the dependent variable.

Table 34: Empirical results about the impact of internal variables on liquidity risk / LQATA

Dependent Variable (LQATA)	Model 10 FE	Model 11 FE	Model 12 FE	Model 13 FE	Model 14 FE	Model 15 FE	Model 16 FE	Model 17 FE	Model 18 FE
Profitability Ratio									
ROAA	-0.091*	-0.094**	-0.018	-----	-----	-----	-----	-----	-----
	(0.046)	(0.046)	(0.057)						
ROAE	-----	-----	-----	0.009	0.012	-0.049	-----	-----	-----
				(0.034)	(0.347)	(0.057)			
NIM	-----	-----	-----	-----	-----	-----	-0.169***	-0.164***	-0.161***
							(0.021)	(0.020)	(0.033)
Capital Ratio									
TCR	0.441***	-----	-----	0.411***	-----	-----	0.406***	-----	-----
	(0.103)			(0.090)			(0.094)		
TIER1	-----	1.326***	-----	-----	1.229***	-----	-----	1.176***	-----
		(0.334)			(0.292)			(0.302)	
EQTA	-----	-----	-0.023***	-----	-----	-0.025***	-----	-----	-0.008
			(0.008)			(0.001)			(0.033)
Credit risk & Quality Management Ratios									
CTIR	-0.005**	-0.004*	-0.006**	-0.002	-0.001	-0.007**	-0.005***	-0.004**	-0.005**
	(0.002)	(0.002)	(0.002)	(0.0023)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
MARS	-0.135*	-0.149**	-0.217**	-0.127*	-0.142*	-0.217**	-0.140**	-0.154**	-0.231***
	(0.076)	(0.076)	(0.092)	(0.077)	(0.077)	(0.099)	(0.061)	(0.064)	(0.072)
LOLTA	0.106***	0.104***	0.104**	0.111***	0.110***	0.054	0.101***	0.097***	0.095**
	(0.039)	(0.037)	(0.053)	(0.038)	(0.036)	(0.065)	(0.035)	(0.034)	(0.046)
Control Variables									
RRR	-0.738***	-0.771***	-0.516**	-0.704***	-0.732***	-0.542**	-0.460***	-0.486***	-0.388***
	(0.136)	(0.141)	(0.209)	(0.144)	(0.148)	(0.242)	(0.118)	(0.119)	(0.157)
IBR	-0.018	-0.022	0.012	-0.038	-0.042	0.033	-0.042	-0.044	-0.011
	(-0.077)	(0.076)	(0.086)	(0.076)	(0.075)	(0.096)	(0.060)	(0.061)	(0.065)
M2GDP	0.013*	0.015**	0.009	0.012	0.013	0.010	0.009	0.010*	0.009
	(0.008)	(0.007)	(0.0095)	(0.008)	(0.007)	(0.010)	(0.006)	(0.006)	(0.007)
DARS	-0.351***	-0.352***	-0.349***	-0.345***	-0.346***	-0.359***	-0.296***	-0.297***	-0.305***
	(0.111)	(0.113)	(0.118)	(0.109)	(0.111)	(0.137)	(0.078)	(0.081)	(0.084)
Constant	4.365***	4.362***	6.261***	4.218***	4.211***	6.505***	4.770***	4.793***	6.534***
	(0.659)	(0.689)	(0.671)	(0.554)	(0.576)	(0.663)	(0.593)	(0.637)	(0.546)
R2	0.769	0.775	0.744	0.759	0.764	0.709	0.825	0.823	0.805
F-statistic	21.292***	22.003	18.555***	20.145***	20.703***	15.614***	30.119	29.792***	26.424***
No. Obs.	156	156	156	156	156	156	156	156	156

This table presents the results of the analysis of the econometric models that were mentioned in the methodology section. The analysis is done for the period 2004 to 2015. The dependent variable in these models was the liquid assets to total assets ratio (LQATA) whereas the internal factors include ratios for profitability, capital, size, non-performing loans and cost to income ratio. The selection of the models between random and fixed effects was based on the results of the Hausman test. Standard errors in the parentheses are the White robust standard errors The asterisk signs refer to the significance of the variables: * Significant at 10% ** Significant at 5% *** Significant at 1%.

Taking a brief look at the results, they indicate that whether the unobserved component is fixed amongst cross-sections or varies were fixed among cross-sections meaning that group means are fixed among cross-sections. These results are the results of using variables that are influenced by the regulations that are set by regulatory bodies such as capital, and measures that are in place related to liquidity, which would be the same across banks. As for the analysis of the results for the explanatory variables, the study has grouped some of these variables based on their definitions. In the empirical estimation, the study has used OLS, random, and fixed effects models in order to estimate the impact of various internal factors on liquidity risk. The analysis will compare the results of different models, though most of the results have the same sign in the three methods.

4.5.2.1 Profitability

In Jordanian commercial banks, lending is considered the main source of income, as interest revenues constitute more than half of the total revenues for the banking sector. In the first three models, profitability as expressed by ROAA was statistically significant at a 90% confidence level in the first two models. An expected (-0.094 to -0.091) percentage change in LQATA when ROAA increases by 1% change as the relationship between liquid assets and liquidity risk is reversed. Thus, an increase in the ROAA would result in a decline in LQATA by a marginally small amount.

In the next three models, ROAE was found to be insignificant. In addition, the NIM was significant at a 99% confidence level in all models, with a higher impact than ROAA and ROAE. An increase in the NIM by one unit would result in a decline in liquid assets between (-0.169 to -0.161). The results for these variables in the OLS models and the random effects models were the same, indicating a negative impact of profitability on liquidity, which has a

positive relationship with liquidity risk; therefore, the researcher can deduct that profitability has a positive impact on liquidity risk in all of the above models.

The same impact of profitability on liquidity risk is found in LQATA models as in the LTD models as profitability, measured by ROAA, has a negative impact on liquid assets, which means that profitability has a positive impact on liquidity risk, indicating that an increase in ROAA at Jordanian banks results in an increase in liquidity risk. In addition, ROAE has a positive but insignificant impact on liquidity risk measured by LQATA, stressing the same results that the study got earlier. Moreover, the NIM impact on liquid assets to total assets was negative at 99% confidence in the last three models, therefore demonstrating a positive impact on liquidity risk.

The results demonstrated that NIM, which is used to express the ability of a bank to generate net revenues from its core functions (extending credit and accepting deposits from counterparts), has a higher and significant impact on liquidity risk, measured by LQATA, compared to the impact of ROAA and ROAE, which include the revenues generated from fees and charges. This is consistent with the conservative nature of commercial banks in Jordan and the low complexity of the financial market in which they operate, which leads to the conclusion that banks' lending growth will be highly associated with liquidity risk as it has a direct impact on NIM.

In addition, the results implicitly indicate that an increase in interest expenses, which result from a rise in liquidity acquired from deposits, has a negative impact on liquidity risk, measured by LQATA. Therefore, an increase in banks' risk appetite would result in an increase in their credit exposures and affect the structure of their balance sheets through decreasing the level of liquid assets held by commercial banks at the expense of liquid assets. Striving to maximise

profits through reducing the amount of liquid assets available would impact bank operations exposure, which in turn would result in a high risk exposure through increased credit lending. In addition, these results indicate that Jordanian banks have limited capacity to access liquidity resources through deposits of wholesale funding, thus positively influencing their liquidity risk. These results were consistent with Wójcik-Mazur and Szajt (2015), who reported a positive relationship between liquidity risk and the interest rate margin ratio, which was attributed to the impact of commercial banks' lending activities on their margin. This is due to the level of lending activity; the greater credit growth may result in a significant increase in NIM. Furthermore, Pagratis et al. (2017) attributed the positive impact to banks' ability to access wholesale funding due to their size, which implies that small banks aim for higher interest rate margins compared to larger banks due to their higher dependence on net interest income as a main factor that constitutes the majority of their profits.

The results came in line with the researcher expectations in the hypothesis section. As banks in Jordan rely mainly on traditional banking as their main source of revenue, maximising their profits would result in greater exposure to liquidity risk. Therefore, banks in Jordan should pay more attention to their market exposures due to its negative impact on liquidity. Adopting more aggressive policies would therefore increase their liquidity risk. The results that the study got are backed by the findings of some articles in the literature, which stated that an increase in profitability would impact liquidity negatively and, therefore, increase banks' exposure to liquidity risk and heighten their need to search for additional funding resources (e.g., Barth et al., 2003; Kosmidou, 2008; Demirgüç-Kunt & Huizinga, 1999; Sufian & Chong, 2008; Wójcik-Mazur & Szajt, 2015; Pagratis et. al, 2017).

4.5.2.2 Capital

Measures of capital that are referred to in the models are widely used in empirical research. The TIER1 is equity capital and disclosed reserves that are divided by risk-weighted assets. TIER1 is considered as a measure of banks' strength and is one of the measures that are implemented by banks and supervised by regulatory authorities in accordance with Basel regulations. It is a measure of a bank's core capital. Similarly, the TCR measures a bank's capital in relation to its risk taken through weighting its assets. The idea behind these two measures is to ensure banks have enough capital to cover the risk posed from their lending activities. Around 50% of TCR comprise of TIER1. Furthermore, EQTA is a measure for the percentage of banks' assets that are funded by private equity. The higher the ratio, the less debt that the company used to acquire assets. This signifies that investors believe that the bank as worth investing in. In addition, it is cheaper to finance through equity as it entails less debt-servicing costs.

The results of the models show that TCR has a significant impact on liquidity risk at a 99% confidence interval, measured by LQATA, in all of the models. An increase in TCR by one unit will result in an increase in LQATA by (0.406 to 0.441), which is translated as a negative impact on liquidity risk. TIER1 also has a positive significant impact on LQATA at a 99% confidence interval, which has a negative impact on liquidity risk. An increase in one unit in TIER1 would result in an increase in LQATA by (1.176 to 1.326). In contrast, EQTA has a significant negative impact on LQATA at a 99% confidence interval between (-0.023 to 0.025), which means that EQTA has a positive impact on liquidity risk as the relationship between liquid assets (LQATA) and EQTA is negative. The impact of TIER1 is higher than TCR and both of them have a different impact compared to EQTA, which is negative and fairly small.

The deviation of the results between those variables is due to the influence of capital regulations that are set by regulatory bodies in accordance with Basel requirements. The difference between the impact of capital on liquidity risk was found to be positive in the case of using LTD and negative when using LQATA as proxies for liquidity risk. This is mainly due to the nature of both indicators and their relationship with liquidity risk. LTD is an indicator that measures the ratio of loans to total deposits, therefore the higher the ratio, the lower the available liquidity at banks and the higher the liquidity risk. LQATA, by contrast, measures the share of liquid assets to total assets. Jordanian banks' ownership structure and their reliance on family finance is an important factor that should be taken into consideration while analysing the impact of capital (Omet, 2005). Accordingly, an increase in capital through private financing would result in an increase in liquid assets, as investors will have a more risk-averse attitude compared to debt financing. However, the increase in bank capitalization will increase the credibility and strength of the bank, increasing the deposits that banks acquire from their depositors.

The rise in resources at banks will increase the cost of holding large amounts of liquidity and the ability of the bank to extend credit. In addition, bank owners will strive to increase the return of their capital injections, which would result in aggressive polices to increase their return through enlarging their credit portfolio. Therefore, increasing capital would result in increasing liquid assets at first, but the following increase in deposits and bullish policies after capitalization would result in an increase in the liquidity risks that banks are facing.

Banks are required to have liquidity buffers in order to cover the operational risks that result from their day-to-day operations. Banks with adequate liquidity buffers would insulate the impact of capital on liquidity risk. The results of the OLS and random effects models indicate

that the TCR and TIER1 variables have a significant positive impact on LQATA, which is translated as negative on liquidity risk while EQTA has a negative significant impact on LQATA, which is translated as a positive impact on liquidity risk in all of the models.

Therefore, the study can deduct that many internal factors influence the impact of capital on liquidity risk at commercial banks in Jordan. The impact will depend on the ownership structure, liquidity holding levels at banks, efficiency of management, and the existence of liquidity buffers at banks, as well as their risk appetite and creditworthiness. Accordingly, it will be hard to distinguish the impact of capital while alleviating the influence of these factors on capital and liquidity risk.

The findings of the empirical estimation were similar to the researcher expectations in the hypothesis section where LQATA is the dependent variable. The researcher had expected banks with higher capital ratios to be exposed to lower liquidity risk levels. Kim and Sohn (2017) and Bonner et al. (2015) indicated that a positive impact of capital is that an increase in the capital ratio increases banks' liquidity holdings. In addition, capital has moderate effects on a financial institution's liquidity buffers as the presence of liquidity regulations neutralizes most of the bank and country-specific factors that affect the size of commercial banks' liquidity buffers.

4.5.2.3 Bank Size

The researcher has used the natural log of the total assets of commercial banks in Jordan – an asset-based measure – in order to estimate the impact of bank size on liquidity risk. The results in the above models were mostly significant at a 90% confidence level and had a negative impact on LQATA, thus positively influencing liquidity risk. An increase of the size by one

unit would result in a decline of (-0.127 to -0.231), emphasizing the negative impact of the size on LQATA.

This indicates that bank size has a positive impact on liquidity risk when using LQATA as a proxy for liquidity risk as larger banks tend to have different operations than core banking businesses, and therefore set lower liquidity target levels. Moreover, banks with a larger share of operations may have higher exposure to market conditions and the cyclicality of the economy, increasing their revenues and their operations at peak episodes while decreasing their asset quality, resulting in an increase in the need for liquidity to cover their risks.

These results are in contrast with the researcher initial expectation that larger banks measured by total assets tend to face higher liquidity risk as the study expected a larger bank to need higher liquidity allocations. The results of the study analysis are backed up by some conclusions from the empirical literature (Aspachs et al. 2005; Agénor et al. 2004; Delechat et al. 2012; Kashyap & Stein, 2000; Gatev & Strahan, 2006), which point larger banks' ability to have lower liquidity targets than smaller banks through their higher efficiency in managing their risks, thus freeing up more liquidity. Being more prone to liquidity risk could be related to the characteristics of Jordanian banks where two banks have more than 50% market share in terms of total assets, which increases the vulnerability of the banking system in Jordan to systematically domestic important banks. This requires further supervision to ensure that they are healthy.

4.5.2.4 Credit

The results indicate that non-performing loans have a positive and significant impact on LQATA at a 95% confidence level in all of the LQATA models, except for the 15th model, where the impact was statistically insignificant. An increase in LOLTA by one unit results in

a rise in LQATA by (0.095 to 0.111). The results in the models captured the influence of credit regulations that are set by supervisory authorities on asset quality and their impact on banks' financial statements. The increase in non-performing loans as a result of the deterioration of the asset quality at commercial banks would result in an increase in the credit risk faced by banks and require increasing provisions against expected losses in accordance with the supervisory regulations. Though regulations have improved asset quality with regards to lending, banks still have to account for loan defaults and expenses that occur. Loan loss provisions are a standard accounting adjustment made to a bank's loan loss reserves included in its financial statements.

Therefore, a rise in non-performing loans would require banks to increase their provisions for the expected losses, which would result in an increase in the levels of liquidity held by banks, which decrease its impact on liquidity risk. The regulations by supervisory authorities seem to have a higher impact on liquidity risk if the above results were compared with the previous models where LTD is the dependent variable. Most of the model results were insignificant except for one model which showed that non-performing loans positively impact liquidity risks in Jordanian commercial banks. The results were similar between the OLS, random and fixed effects models.

Accordingly, the impact of an increase in credit risk due to a rise in non-performing loans would increase the level of liquid assets held by banks and therefore negatively impact liquidity risk. This impact comes directly from loan loss provisions, which have a higher impact in Jordan than other influences on risk appetite and the confidence of depositors. The results in the LQATA models were counterintuitive to the researcher expectations in the hypothesis section that commercial banks with high non-performing loans face higher liquidity risk. The

results in the LTD models were mostly insignificant but had a different sign. These results can be explained by the impact of the regulations set by supervisory authorities on credit exposures and the need for banks to make loss provisions against their bad loans. The results for both models were backed by the results found by Imbierowicz and Rauch (2014), who concluded that there is no economically meaningful relationship between liquidity risk and credit risk. They indicated that the interaction between liquidity risk and credit risk increases the probability of default among banks, which calls for joint management of these risks in banks.

4.5.2.5 Management Efficiency

The findings of the models indicate that the cost to income ratio (CTIR), which is used as a proxy for the quality of management in the analysis, signals a bank's ability to generate more profits from revenue sources through minimizing costs. A higher CTIR suggests lower-quality management. CTIR has a negative impact on LQATA at a 90% confidence level in most of the models. An increase in CTIR by one unit, which is used as a proxy for quality of management, would result in a decline in LQATA by (-0.004 to -0.007), implying a fairly small negative impact between quality of management and liquidity risk. The results were also similar in the OLS, random, and fixed effects models but mostly insignificant in the OLS and random effect models.

An increase in the CTIR, which is a proxy for the quality of management, due to a deterioration in the quality of management would result in a decline in the level of liquid assets held by commercial banks, which in turn would positively impact liquidity risk. Therefore, the study can deduce that there is a negative but small influence between the quality of management and liquidity risk. The results could be explained by the impact of the quality of management on banks costs, which usually decline when management can allocate resources more efficiently,

thereby minimizing bank costs and increasing revenues. This is related to cost management, which emphasizes maximising revenue per unit of cost. Quality of management is an unobserved variable that is hard to estimate due to the intangibility of banks' products and services.

These results are strongly related to the environment under which Jordanian banks operate. The cost to income ratio (CTIR) is considered an important factor as it is closely linked to the core functions of banks due to the nature of activities of domestic banks that are mainly linked to extending credit to various institutions. Therefore, the researcher could view this ratio in Jordan as the average revenue per unit cost for credit facilities because the majority of revenues for domestic commercial banks comes from interest payments, which indicate that more efficient management for resources would result in an increase in revenues per unit cost, which results in a decline in the liquidity risks faced by banks.

The results were in tandem with the researcher initial assessment in the hypothesis section that commercial banks with higher efficiency face lower liquidity risks. Moreover, these results were consistent with the evidence in the empirical literature that having better quality management contributes decreases liquidity risk exposure (Maudos, et al., 2002; Dietsch & Lozano-Vivas, 2000; Resti, 1997; ECB, 2010).

4.5.2.6 Control Variables

Some of the control variables, which include regulatory and macroeconomic variables, have been statistically significant in most of the models, especially RRR in Table 34. The reported results were also similar to the OLS, random and fixed effects models. The findings show that RRR has a significant negative impact on LQATA at a 95% confidence level for all of the

LQATA models, indicating that required reserve ratios have a positive impact on liquidity risk as higher required reserves at the central bank decrease the amount of liquidity available.

The impact of interbank interest rates on LQATA was insignificant in all of the models. M2GDP had a significant impact of LQATA in the three models at a 90% confidence level, but a fairly small one. An increase in M2GDP, which is a complex concept that expresses long-term economic growth, would result in an increase in LQATA, and decrease the level of liquidity risk faced by commercial banks. The dummy variable which represents the impact of the Arab Spring that started since 2010 had a negative impact on LQATA, which is translated into a positive impact on liquidity risk. This indicates that Jordanian banks have been negatively impacted by their macroeconomic environment as it decreases their ability to collect funding through deposits as well as extend credit in the market due to the difficult external conditions. These results, especially for the regulatory variables, were backed by findings in the empirical literature (Laurine, 2013; Berger et al., 2016; Kim & Santomero, 1988; Eichberger & Summer, 2005; Ben Naceur and Roulet, 2017; Laeven et al., 2016).

4.5.3 Post Estimation Test Results

The researcher has employed several tests to check for the robustness of the models used in the analysis. The following table shows the results of the adopted models in the analysis (fixed and random effects models). The F-statistics test is used to test the overall significance of the regression model. Specifically, it tests the null hypothesis that all of the regression coefficients are equal to zero. This tests the full model against a model with no variables and with the estimate of the dependent variable being the mean of the values of the dependent variable. This shows that all of the models of LTD and LQATA were significant at the 1% confidence level. The R-squared results were relatively high, indicating that the variables in the models explain

most of the variations in the independent variables. Moreover, the J-B test shows that the residuals of the regressions were normally distributed. The VIF for the models shows that multicollinearity does not exist in the models as all of the results were below the 10 threshold. The redundant fixed effects tests show that the effects were significant in all of the fixed effects models that were selected based on the Hausman test results.

Table 35: Robustness tests for the LTD and LQATA models

Test	Model 1 RE	Model 2 FE	Model 3 RE	Model 4 FE	Model 5 FE	Model 6 RE	Model 7 FE	Model 8 FE	Model 9 RE
F-statistic	4.955***	15.142***	8.717***	13.194***	13.071***	8.641***	28.668***	28.709***	18.266***
R^2	0.234	0.703	0.349	0.674	0.671	0.347	0.818	0.818	0.529
JB-Test	0.820	2.246	1.776	1.669	1.711	2.193	1.439	1.463	2.348
Heteroscedasticity test	4.040***	1.723	3.892***	2.33**	2.326*	3.898***	1.534	1.441	1.173
VIF	1.305	3.367	1.536	3.067	3.039	1.531	5.495	5.495	2.398
Redundant fixed effects	-----	15.342***	-----	12.961***	12.748***	-----	23.567***	24.220***	-----
Hausman test	13.63	-----	3.87	-----	-----	12.97	-----	-----	9.05
Wooldridge serial corr.	13.619***	0.974	15.231***	4.393	0.459	17.393***	1.942	1.273	34.865***

Test	Model 10 FE	Model 11 FE	Model 12 FE	Model 13 FE	Model 14 FE	Model 15 FE	Model 16 FE	Model 17 FE	Model 18 FE
F-statistic	21.292***	22.003	18.555***	20.145***	20.703***	15.614***	30.119	29.792***	26.424***
R^2	0.769	0.775	0.744	0.759	0.764	0.709	0.825	0.823	0.805
JB-Test	2.817	2.993	3.633	2.746	2.905	0.901	2.962	3.127	2.209
Heteroscedasticity test	1.727	1.556	1.751*	1.576	1.449	1.799	2.346*	2.200*	2.118*
VIF	4.329	4.445	3.906	4.149	4.237	3.436	5.714	5.649	5.128
Redundant fixed effects	3.964***	4.226***	3.987***	3.597***	3.801***	2.737***	5.479***	5.708***	5.515***
Hausman test	-----	-----	-----	-----	-----	-----	-----	-----	-----
Wooldridge serial corr.	0.864	0.974	1.252	1.535	1.710	0.925	0.067	0.107	0.588

This table presents the robustness test results for the LTD and LQATA models. The tests include the F-statistic test to see the significance of the overall models; R^2, which is a statistical measure of how close the data are to the fitted regression line; the Jarque-Bera test to gauge the normality of the residuals; the White heteroscedasticity test to see whether the data suffers from unequal variability across the range; VIF results, which quantify the extent of correlation between one predictor and the other predictors in a model; the redundant fixed effects to test the significance of the effects; the Hausman test to choose whether the fixed or the random effects are more appropriate; and the serial correlations test. The asterisk signs refer to the significance of the variables: * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

However, some of the models suffered from heteroscedasticity and serial correlation in the LTD models, namely models 1, 3, 4 and 6 for heteroscedasticity and 1, 3, 6 and 9 for serial correlation. As for the LQATA models, the test results confirms that they did not suffer from statistical problems such as heteroscedasticity or autocorrelation. The reason behind the problem is that the structure of the banking system in Jordan is concentrated with two banks having a market share of more than 50%, which is the reason why the data had to be Winsorized before estimating the models.

4.6 Conclusions

The analysis in this chapter covered 13 domestic commercial banks in Jordan during the period 2004 to 2015 to estimate the impact of banks' internal factors – namely, profitability, capital, credit risk, size and quality of management – while controlling for the regulatory and macroeconomic environment. The researcher has used the loan-to-deposit ratio and liquid assets to total assets ratio as proxies for liquidity risk limited by the available data from banks' financial statements. The used data had outliers due to the structure of the banking sector in Jordan where two banks share, in terms of assets, more than 50% of the market. Therefore, the data was Winsorized at the level of the 90^{th} percentile to remove outliers.

The study has faced several limitations while conducting this research. The first was the limited data available as only 13 of the 21 banks had data available. Therefore, the analysis covered 13 domestic commercial banks. Data could not be obtained for the others through the BankScope database or manual data entry as these banks are considered as branches of foreign banks that reside in Jordan and their balance sheets are often consolidated into their foreign counterparts and not published separately. Moreover, the limited availability of long time-series data for each bank constrained the researcher to investigate the research problem in a time span that is

in parallel with the development of the banking system in Jordan. In addition, very few studies have investigated the impact of internal factors such as profitability, capital, credit, size and quality of management on liquidity risk within Jordanian commercial banks, whether domestic or foreign branches, and most relevant studies in the literature have focused on the impact of these factors on profitability.

The econometric techniques used in this chapter were OLS, fixed and random effects, which were mainly used in order to observe the behaviour of the unobserved component between cross-sections in the estimated models. The results showed that profitability has a positive impact on liquidity risk. The influence of profitability comes from the limited liquidity resources that banks have in Jordan. An increase in banks' risk appetite would result in an increase in their credit exposures and affect the structure of their balance sheets through decreasing the level of liquid assets held by commercial banks at the expense of liquid assets. Striving to maximise profits through reducing the amount of liquid assets available would impact bank operating exposure, which would result in high risk exposure through increased credit lending.

The analysis shows asset quality deteriorated due to a rise in non-performing loans, and the impact of capital on liquidity risk is influenced by regulatory measures set by the supervisory authorities in addition to internal measures that banks take in order to ensure their viability, such as limiting certain exposures and the existence of liquidity buffers. Therefore, the impact of capital and credit – represented by Tier 1, the total capital ratio and equity to total assets and non-performing loans – on liquidity risk was found to be ambiguous due to the interactions between different factors.

The impact of bank size, measured by the percentage of bank assets to total banking assets, was different between the two main variables (LTD and LQATA) as larger banks tend to have more operations than just their core banking business, and have more efficient management of liquidity, therefore requiring lower liquidity target levels. Larger banks will also attract more clients and increase their liquid assets through their market power. Moreover, banks with a larger share of operations may have higher exposure to market conditions and the cyclicality of the economy. This can increase their revenues at peak episodes while decreasing their profits and assets quality, resulting in an increase in the need for liquidity to cover their risks, though they are considered more efficient in terms of managing their liquidity.

The impact of the quality of management on bank costs, which usually decline when management can allocate resources more efficiently, minimizes banks costs and increases revenues. This is related to cost management, which emphasizes maximising revenue per unit of cost. Quality of management is an unobserved variable that is hard to estimate due to the intangibility of banks' products and services. The core functions of Jordanian banks are mainly linked to extending credit to various institutions. Therefore, the researcher could view this ratio in Jordan as the average revenue per unit cost for credit facilities because the majority of revenues for domestic commercial banks come from interest payments, which indicate that more efficient management of resources would result in an increase in revenue per unit cost. This results in a decline in the liquidity risks faced by banks.

The control variables for the regulatory environment had a positive impact on liquidity risk with regards to the required reserve ratio where an increase in the percentages required by the authorities results in a decline in the amount of liquid assets available. Moreover, the impact of interbank interest rates was found to be positive as higher interest rates could increase banks'

exposures to liquidity risk as it increases the costs borne by banks to secure available funding from the market. The macroeconomic environment control variable was statistically insignificant in most of the reported models, indicating that the regulatory measures set by the central bank plays a crucial role in insulating Jordan's commercial banks from the impacts of macroeconomic cycles. Nevertheless, the dummy variable which represents the impact of the Arab Spring that started in 2010 had a positive impact on liquidity risk. This indicated that Jordanian banks have been negatively impacted by their macroeconomic environment as it decreased their ability to collect funding through deposits as well as extend credit to customers.

The findings indicate that internal factors have a major impact on the liquidity risk faced by commercial banks in Jordan. These influences are intertwined with the regulatory measures imposed by the regulatory authorities, which signals that most banks depend on regulatory frameworks to manage their risks. Moreover, the results points to the importance of the risk appetite of commercial banks and their impact on liquidity exposures, which will be influenced in the near future by the adoption of Basel III. The issue of size plays an important role in terms of banks' exposure to liquidity risk, signalling the importance of having more supervision for larger banks in order to reduce their systemic risks and ensure their viability. Finally, the existence of efficient management team who can allocate resources more efficiently can limit the liquidity risks facing banks.

The implication of the results discussed above and the study analysis is that when trying to understand the internal factors that impact liquidity risk within Jordan's commercial banks, it is necessary to include all of the abovementioned factors and not only consider direct contributors to liquidity risk. Therefore, banks in Jordan should take into account the impact of credit, capital, size, profitability, management quality and regulatory and macroeconomic

factors when setting liquidity risk exposures. These factors should be analysed and reported on a regular basis to the ALCO committee, which is responsible for determining the bank's asset-liability management framework.

Table 36: Correlation Matrix

Variable	LTD	LQATA	LOLTA	IBR	EQTA	CTIR	M2GDP	MARS	NIM	ROAA	ROAE	RRR	TCR	TIER1
LTD	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
LQATA	-0.361***	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
LOLTA	0.252***	0.051	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
IBR	0.119	0.341***	-0.018	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
EQTA	0.410***	-0.251***	-0.216***	0.075	1	-----	-----	-----	-----	-----	-----	-----	-----	-----
CTIR	0.109	-0.063	0.342***	-0.146*	-0.228***	1	-----	-----	-----	-----	-----	-----	-----	-----
M2GDP	0.014	0.542***	-0.040	0.427***	-0.077	-0.133*	1	-----	-----	-----	-----	-----	-----	-----
MARS	-0.230***	-0.008	-0.181**	-0.127	-0.033	-0.074	-0.214***	1	-----	-----	-----	-----	-----	-----
NIM	0.394***	-0.276***	0.078	-0.082	0.082	0.017	-0.105	0.025	1	-----	-----	-----	-----	-----
ROAA	0.040	0.205**	-0.160**	0.290***	0.129	-0.406***	0.350***	-0.129	0.258***	1	-----	-----	-----	-----
ROAE	-0.114	0.318***	-0.065	0.271***	-0.216***	-0.325***	0.392***	-0.120	0.210***	0.932***	1	-----	-----	-----
RRR	0.175**	-0.177**	-0.283***	0.122	0.184**	0.017	0.204**	0.060	0.150*	-0.059	-0.134*	1	-----	-----
TCR	-0.121	0.165**	-0.381***	0.154*	0.548***	-0.152*	0.163*	-0.336***	-0.128	0.222***	0.035	0.033	1	-----
TIER1	-0.113	0.104	-0.391***	0.123	0.574***	-0.210***	0.092	-0.311***	-0.143*	0.220***	0.015	0.062	0.969***	1

This table reports the correlation coefficients of all variables used over the period from 2004-2015 for the original data. The asterisk signs refer to the significance of the variables: * Significant at 10% ** Significant at 5% *** Significant at 1%, respectively.

Chapter Five: Main finding, Conclusion, Recommendations and Final Remarks

5.1 Main Findings

The main findings of the first part, which is related to a survey carried out with the commercial banks population in Jordan, shows that all commercial banks have an ALM process to address the many risks and challenges that are or may be faced by banks in the near future. The primary aim of ALM at Jordanian commercial banks is to manage risk exposure. The main role of ALM is to provide metrics for various types of risk exposure and to help financial institutions hedge against risks (Choudhry, 2011; Zawalinska, 1999). The ALM process deals with managing risk exposures, asset liability mismatches and pricing interest rate products through covering investment and hedging strategies, methodologies for measuring risks, and limit-setting and control to a lesser degree. In addition, the results shows that most banks' ALM strategy is consistent with the overall strategy of the bank.

Most of these banks also indicated that the two main risk exposures that the ALM process is concerned about is managing liquidity and interest rate risks, respectively. Managing these risks is done through various tools depending on the scope of the ALM process at each bank. For liquidity risk, banks indicated that the main tools that they use in managing these risks are cash flow matching, asset liability projections, and duration matching in order to preserve the solvency of the bank and its ability to meet its financial obligations (Vij, 2005). As for the functional scope of ALCO, which is the implementation arm of the ALM strategy, the results show that liquidity risk is its main focus, followed by interest rate risk, market risk, exchange rate risk, and credit risk, respectively. The risk that arises from volume and maturity

mismatches of assets and liabilities is a core focus of ALCO (Bessis, 2015). However, around half of the respondents indicated that ALCO is not responsible for setting risk exposure limits for liquidity risk, as banks should abide by regulatory measures and central bank guidelines in this regard, such as the legal liquidity ratio and loan to deposit (LTD) ratio. As for the interest rate risk, the interest rate gap and dollar duration (DV01) are the metrics of interest rate risk. Moreover, liquidity reports provided to ALCO contain risk exposures, funding liquidity plans, which focus on the overall performance of a bank, as well as the business level and must focus on proposing strategies that could enhance the performance in the future and would allow the bank to tackle any challenge it is facing or will face (Suresh & Krishnan, 2018).

Most of the banks agreed that their adopted strategies are periodically reviewed but the frequency of this oversight differs from one bank to another. They also agreed that the department that tends to be most responsible for managing liquidity risks is the treasury department as it is also responsible for managing the balance sheet, as indicated in the survey. Some banks indicated that risk management finance departments had a role in managing liquidity risks. Furthermore, Jordanian commercial banks indicated that they assess/monitor liquidity risks mainly through contractual maturity mismatch that expresses the gap in liquidity inflows and outflows arising from long-term illiquid assets and liquid liabilities (Adalsteinsson, 2014; Pohl, 2017). Furthermore, the results show that using the concentration of funding indicator tool, and liquidity metrics, market-related monitoring as well the available unencumbered assets indictor are used to assess liquidity risk. Liquidity shortages are mainly dealt with through the Inter-bank market where banks borrow

to cover their shortages. Others indicated that they used the facilities of their central bank as the lender of last resort, and secondary markets as manly the banks have lower liquidity targets as they rely on the lender of last resort in case of shortages (Aspachs, et al., 2005; Vodova, 2011). The survey results shows that liquidity risk is the main focus of ALM and the focal point for the ALCO. In parallel, it indicates an over-reliance in the market on central bank guidelines and the absence of a comprehensive liquidity management strategy at banks as some of them indicated that they have used and identified the lender of last resort as one of the main tools for covering liquidity shortages. Therefore, the second part of this thesis focused on the impact of internal factors on liquidity risk at commercial banks while controlling for regulatory and macroeconomic factors.

The second part of this thesis shows that internal factors have a big impact on bank liquidity. The empirical models showed that a rise in profitability would negatively impact banks in Jordan as they rely heavily on traditional banking as a main source of revenue, and maximizing their profit would result in higher exposure to liquidity risk. There is therefore a positive relationship between liquidity risk and interest rate margin ratio, which is attributed to the impact of the lending activities of commercial banks on their margins (Wójcik-Mazur & Szajt, 2015). In addition, capital showed a positive impact on liquidity risk. These results show the influence of regulatory frameworks that are set be supervisory authorities in accordance with Basel requirements (around 8% of risk-weighted assets). In addition, banks are required to have liquidity buffers in order to cover their operational risks that result from a bank's day to day operations. Capitalized banks also have stronger growth in their balance sheets; accumulate less high quality liquid assets tend to finance their risky

activities through short-term debt are vulnerable to liquidity shocks and shortages (Banerjee & Mio, 2017).

Moreover, bank size had a negative impact on liquidity risk, as large banks tend to have different operations beyond their core banking business. Moreover, large banks are more attractive to high-liquidity clients and companies and retailers as safe-guard of their money that minimizes liquidity risks by enhancing liquidity positions. In addition, large banks' branch networks also enrich their liquidity position. The findings of the models indicate that the negative impact between quality of management and liquidity risk. An increase in the level of cost to income could be attributed to management having lower efficiency regarding managing risks. This would result in banks facing higher liquidity risk, and could be explained by the impact of the quality of management on banks' costs. CTIR illustrates firms' ability to generate profits from their revenue sources (ECB, 2010), which ordinarily decline when management are more efficient at allocating resources. As for credit risk, which is proxied by non-performing loans, the models indicate that there is no significant relationship with liquidity.

Regulatory control variables had a significant and positive impact on liquidity risk. These results could be clarified through the impact of higher required reserves from the central bank, which decreases the amount of liquidity available. Macroeconomic variables showed an insignificant impact on liquidity, indicating that the regulatory measures set by the central bank also play a crucial role in insulating the impact of macroeconomic cycles on the commercial banks in Jordan. Nevertheless, the dummy variable – which represents the impact of the Arab Spring that started in 2010 – had

a positive impact on liquidity risk, indicating that Jordanian banks have been impacted negatively by the macroeconomic environment as it has decreased their ability to collect funding through deposits as well as expand their credit exposure in the market due to the difficult external conditions.

5.2 Conclusion

Commercial banks in Jordan are vital for financing other sectors. The turmoil in the MENA region and eruption of the Arab Spring in 2010, as well as the Global Financial Crisis, exacerbated the challenges that banks in MENA area face, including Jordan. The thesis addressed commercial banks in Jordan in two sections. The first concerned exploring the current ALM frameworks and roles of ALCO in Jordanian commercial banks through questionnaires that comprised of a sequence of questions to capture information from respondents. The banking sector in Jordan comprises 25 banks, 4 of which are Islamic. The rest (21) are commercial banks, 13 of which are domestic and the rest foreign. The questionnaire was distributed to all of the commercial banks in Jordan excluding Islamic banks as they adhere to Islamic Sharia Law, which proposes a different way of managing banks assets and liabilities. The second part of the thesis was concerned with the factors the impact liquidity risk in banks and focused on internal factors such as profitability, capital, credit, size and quality of management while controlling for the impact of the regulatory and macroeconomic environments on commercial banks. The data used was acquired from the BankScope database and the central bank of Jordan for 13 banks (depending on data availability) for the period 2004 to 2015.

The survey results indicate that Jordan's commercial banks already have an ALM process that governs their assets and liabilities management and that the ALCO is responsible for the ALM process but is not responsible for setting risk metrics that quantify various risks. Rather, it is only responsible for setting risk exposure limits. In addition, the inputs for the ALCO lack comprehensive reports about the overall economic and financial market conditions. The Jordanian commercial banks were neutral about their board of directors' adoption of the strategies set out in the ALCO reports. Most of the respondents indicated that the CEO and board of directors of their bank were responsible for reviewing the ALCO report. ALCOs meet regularly, usually on a monthly basis, but ALM strategy assessments differ from bank to bank. In addition, banks perform stress-testing on a regular basis (quarterly) and review their CFP each year. Most Jordanian commercial banks have technical liquidity buffers, which indicate that banks hold mandatory reserve requirements at the central bank of Jordan without benefiting from the remuneration period, and 80% cover liquidity shortages through the inter-bank market.

The results of the second part, which examined thirteen domestic commercial banks in Jordan during the period 2004 to 2015 to estimate the impact of banks' internal factors on liquidity risk, showed that profitability has a positive impact on liquidity risk. The influence of profitability comes from the limited liquidity resources that banks have in Jordan. An increase in banks' risk appetite would result in an increase in their credit exposures and affect the structure of their balance sheets. The impact of bank size, measured by the percent of its assets to total assets, was different between the two main variables (LTD and LQATA) as larger banks tend to have different operations beyond their core banking business, and have more efficient management of liquidity;

therefore, they have lower liquidity targets and also tend to attract more clients. This increases their liquid assets through their market power. The impact of the quality of management on liquidity risk was proxied using the cost to income ratio. This usually declines when management are more efficient at allocating resources. In Jordan, this ratio could be viewed as the average revenue per unit cost for credit facilities because the majority of revenues for domestic commercial banks comes from interest payments. This indicates that more efficient management of resources would result in an increase in revenues per unit cost, which results in a decline in the liquidity risks faced by banks.

The impact of capital on liquidity risk is influenced by the regulatory measures set by supervisory authorities. The impact of capital and credit, represented by Tier1, the total capital ratio and equity to total assets and non-performing loans, on liquidity risk was found to be ambiguous due to the interactions between the different factors.

5.3 Research Contribution

This research will contribute to the existing body of knowledge through providing a fair assessment of the current ALM framework in Jordan as, to the best of the researcher's knowledge; very few studies have yet been concerned with the ALM framework in the MENA region in general and in Jordan specifically. This research will conduct a survey of all Jordan commercial banks to explore the current ALM framework, the main duties of ALCO, and the focus of ALM in terms of risks and the tools that are used to mitigate against these risks. In addition, the survey will enrich the body of knowledge through surveying commercial banks' practices in dealing with liquidity risk through ALM.

In additions, this research will enrich the existing literature in terms of the tools, as the survey tool that used in this research built in a way to cover most of aspects of risks management behaviour for banks in general and commercial banks in particular covered most of the techniques that could applied in other banks environments. The shape of this study could be helpful for the researchers in field of risk management studies and banking management.

The outcome of the survey show that not enough attention is being directed to this issue some variety in the role of ALCO is shown as well as its structure within the commercial banks, implicitly indicating that there is no clear definition from the supervisory authorities on the main roles of ALCO within ALM in Jordan. Taking into account the political volatility of the region and its impact on banks operations, commercial banks are using different metrics to set their exposures although the macroeconomic, regulatory and products are relatively the same, pointing to the level of risk appetite on which these banks operate and their dependency on the central bank in setting metrics for risks. In addition, about 40% of the population have indicated market risk as being the most important risk factor, followed by credit risk at 20%, shedding light on the vulnerability of the banking system in Jordan to the political instability in the region, which impacts both macroeconomic and financial conditions. This is reflected in banks' risk appetites as most banks indicated that they are avoiding high-risk exposures to reduce their overall risk.

Therefore, this study is one of the first studies to present the ALM process and main responsibilities of ALCO within the population of commercial banks in Jordan. This study also tests whether the ALM process is effective in commercial banks through

employing a set of sub-hypotheses related to managing banks' balance sheet, namely: the main types of risks, such as liquidity, credit, market, and interest rate risks. It also looks at the stress testing and contingency funding plans that banks adopt based on their supervisory authorities' instructions.

Furthermore, the second part of this thesis will assess the impact of various variables related to banking operations and the regulatory framework in Jordan, including the impact of macroeconomic conditions on Jordanian commercial banks' liquidity. In addition, the study will deduct useful conclusions and recommendations that would help the banking industry to enhance the existing ALM framework, and help banks to develop a comprehensive and applicable ALM framework tailored to the Jordanian banking system by identifying the main factors that impact liquidity risk.

The results in the second part clearly indicate that internal factors have a major impact on liquidity risk as the strategic plan of commercial banks impact the structure of banks' balance sheet and their operations, and thereby their liquidity positions and risk exposures. Therefore, having a consistent strategic plan that is aligned with the bank goals regarding maximizing profits and risk appetite, while mitigating against risk exposures, is imperative to control changes in these factors.

For example, the results indicated that profitability had a positive impact on liquidity risk, which in the case of Jordanian banks should be warranted by the limited resources that banks have, their limited access to wholesale funding, and their reliance on conventional banking as their primary means of generating revenues. On the other hand, the quality of management had a negative impact on liquidity risk, implying the importance of having an efficient management who are able to set strategic plans and

limits on risk exposures and risk appetite taking the regulatory and macroeconomic circumstances in Jordan into consideration.

To the best of my knowledge, the study found no previous research on Jordanian banking that have the same scope as this questionnaire as most of the available studies only study the ALM as a small part of banks' process of maximizing profit without getting into detail about how the ALM process actually works and the role and the scope of the ALCO.

5.4 Policy Implications and Recommendations

The results of this study provide some implications for policy-makers, banks shareholders, academics, as well as, regulatory institutions such as the central bank of Jordan. Central banks in countries with similar banking sector, characteristics may find the results useful for drafting regulations and policies related to liquidity risk management in commercial banks. This would help to safeguard the banking sector through encouraging banks to develop guidelines for liquidity management that promote transparency in risk management. Regulators could also use this study to set guidelines built on the recommendations of the Basel committee. The general findings in this study, if shared with other researches, will have remarkable implications in chart up risks identifications for financial institutions as well as developing internal reporting systems for ALCOs.

The main conclusions of the research clearly show that internal factors have the biggest impact on liquidity risk. Only half of the population in the survey are concerned with meeting the liquidity requirements set by their central bank. This indicates the lack of a comprehensive framework for liquidity management at commercial banks given the

limited capacity of ALCOs to set risk exposures in some banks. This highlights the importance of the regulatory body to help banks construct a framework for liquidity management that takes a holistic approach to dealing with issues related to transparency in risk management, proper delegation of authorities, adequate reporting, and funding sources. Such frameworks should be a part of the strategic plans and targets set by banks.

It is hard to set out one best strategy for liquidity management – but multi strategies can be adopted to achieve banks goals in profit and growth and enhance commercial banks' abilities in managing their liquidity positions and risks. It is Worth to point out the growth in banks' balance sheet is crucial, it need an appropriate framework support this growth and minimize the risks. Therefore, banks' ALM strategies should be organised with other risk plans implemented first followed by banks goals to support and ensuring banks sustainable growth.

Accordingly, the main recommendations from the thesis can be summarized as follows:

I. Clear framework for liquidity risk management:

The Jordanian commercial banks should ensure the consistency of their liquidity management frameworks with the strategic objectives of operational divisions, taking into account the asset and liability structures, capital positions and liquidity on different stages, by currencies, products and terms. The liquidity risk framework is extremely important from the viewpoint of ensuring the soundness and suitability of banking system, the bank management is responsible for taking the initiative in chart up a clear liquidity risk management framework, and reviewing in Periodic manner whether the framework is appropriate to the bank risk profile, and the nature of its business.

II. Setting a proper reporting system for ALCO with adequate terms of reference:

There are no international guidelines that set the main terms of reference for ALCO core functions and its designated authority to identify and set risk exposures. Therefore, setting a general framework for banks to serve as a guide for an ALCO, with the understanding that the ALCO may carry out additional functions and adopt other policies and procedures as may be appropriate in light of changing business, legislative, regulatory and other conditions, might be useful in reaching a census about the committee's core functions and streamlining the process across banks, which would help to reform the process.

Furthermore, streamlining the process should be in parallel with the reporting system for the ALCO, which should include some main macroeconomic and financial conditions as well as the main risk exposures at the bank such as liquidity, interest rate and credit risk. A feedback mechanism should be established between the board of directors and the ALCO through the CEO in order to ensure the consistency of the overall bank strategy.

III. Having a CFP that is continuously updated:

CFPs at commercial banks should be reviewed periodically, which includes testing the CFP, reviewing threshold values for early warning signals and defined normal levels for the liquidity risk indicators and updates to the CFP. These changes should take into consideration developments in macroeconomic and financial conditions as well as changes in the adopted business model.

IV. Enhancing coordination between banks and supervisory authorities:

Supervisory authorities, represented by the central bank in Jordan, have taken a keen interest in supervising financial institutions' liquidity positions as well as liquidity risk levels, especially after the Global Financial Crisis, which urged the Basel committee to issue the Basel III guidelines that are mainly concerned with liquidity management. These changes have increased the regulatory burden on the central bank and increased banks' reliance on its guidelines with regards to liquidity, as shown by the survey results. Accordingly, banks could still be lacking a comprehensive framework related to liquidity risk management. Therefore, increased coordination between banks and central banks is needed through establish systems for assess and measure risks. The results of the survey indicated that ALM processes are effective in most Jordanian commercial banks, as supported by the results of the sub-hypotheses. Still, some actions should be taken in order to insulate banks from liquidity risks, taking into consideration the political instability in the region and its impact on the macroeconomic conditions. Therefore, the following are a set of recommendations for commercial banks that could be implemented:

Commercial banks should reform the ALCO process as follows:

ALCO should identify risk metrics that can be used to identify risk exposures as ALCO is not responsible for identifying these metrics at present. Therefore, ALCO should be more involved in this process. Moreover, around half of the study population indicated that their ALCO is not responsible for setting risk exposures as banks are only concerned with meeting their minimum regulatory requirements. Therefore, the involvement of ALCO in setting risk exposures should be encouraged by supervisory

authorities as it would increase the effectiveness of banks in managing both sides of their balance sheet.

Furthermore, inputs for the ALCO should be comprehensive and take into account changes in the overall economic and financial market conditions.

Some banks do not provide the ALCO with credit risk concentration data and forecast reports as they only aim to meet the minimum requirements set by the central bank. Thus, a remedial action should be taken by the commercial banks as the ALCO is responsible for proposing strategies to the board of directors regarding liquidity positions, product lines, and the overall strategy of the commercial bank.

A feedback mechanism should be set between the board of directors and ALCO through the CEO in order to ensure the consistency of the overall bank strategy.

The supervisory authorities, represented by the central bank, should take into consideration the results of this survey given the emphasis of Basel III on liquidity management, which is an integral part of the ALM process. More specifically, central banks should be involved in laying the fundamentals of ALM and ALCO through structuring an overall framework for commercial banks to follow that clearly identifies the responsibilities of the ALCO as the results of the survey show that their responsibilities vary from bank to bank. As 50% of ALCOs in banks are responsible for setting risk exposures, different banks have different exposure metrics.

5.5 Research Limitations

This research came up against a number of limitations. The limitations in the ALM part were as a follows:

- **Limited population:** The Jordanian economy is a small open economy with a banking sector comprised of 21 commercial banks and a number of Islamic banks. Therefore, this is a limited population to survey.
- **Lack of prior research studies:** According to the best of the researcher knowledge, very few studies have yet surveyed ALM processes.
- **Bank responsiveness:** The researcher confirmed to the banks that the results of the survey would not be published on a bank-by-bank level. However, the responses from the banks may not reflect their real resource-management processes due to disclosure issues or the respondents' lack of knowledge of their actual ALM processes.

In addition, the study faced some limitations in the liquidity risk evaluation part as follows:

- **Data limitations:** There are 21 commercial banks in Jordan. Thirteen are domestic banks and the rest are foreign banks branches. In this part of the paper, the analysis only included the 13 domestic commercial banks as data for the rest of the population could not be obtained through the BankScope database or through manual data entry as the other 8 commercial banks are considered branches of foreign banks that reside in Jordan but whose balance sheets are often incorporated in the consolidated balance sheet of the foreign parent and are not published separately. Moreover, the researcher could not estimate the liquidity gap indicator due to limited data releases from these banks in their balance sheet. In addition, the small-time span of the data is considered another limitation that led to having a relatively small dataset.

- **Lack of prior research studies:** According to the best of the researcher knowledge, very few studies have investigated the impact of internal factors such as profitability, capital, credit, size and quality of management on liquidity risk at Jordanian commercial banks, whether domestic of foreign branches. Most previous studies have focused on the impact of these factors on profitability.
- **Longitudinal effect:** Compared to the long history of literature on bank management in both a global as well as domestic context, this research was carried out over a fairly short period of time.

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Appendices

Appendix 1:

Table 37: Main studies that investigated Asset and Liabilities Management

Authors/ Year	Country	Period	Methodology	Findings
(Zawalinska, 1999)	Banks In Poland.	1999	Survey techniques	Liquidity risk as having the greatest influence on the decisions of their bank. The credit risk as the second most important risk. Most of the Poland banks have both a formal ALM policy and an ALCO. Nevertheless, three or 9 percent of the surveyed banks have no formal ALM policy, and only two have no ALCO. ALCO meets either once a week or twice a month. Highlighted the importance of privatizing public banks to improve profitability, efficiency and risk management, it create a favourable climate for implementation of more advanced risk Management and measurement techniques.
(Alam & Masukujjaman, 2011)	five commercial banks in Bangladesh	2010	Questionnaire survey	Credit risk as the first important risks followed market risk, operational risk. Liquidity risk. The main risk oversight is responsibility of Board of Directors; the Executive Committee monitors risk, while all banking operation activities oversees by the Audit Committee. The banks employ the credit policy with the approval from Board of Director of Credit risk management division for their credit risk management. Bank maintains customer's confidence is maintained in ensuring liquidity this the opinion regarding liquidity risks. Internal rating system and risk-adjusted rate of return on capital were the important techniques used for Managing Risk.
(Toby, 2010)	24 Nigerian Deposit Money Banks.	2007-2008	Questionnaire and interview	The meltdown of stock market as affecting banks liquidity profiles the most in Nigeria. The loose monetary policy make portfolio constrain on Nigerian balance sheet. The banks held more shout term investment than long-term after the financial crisis, and held more primary cash with the RR due the wake of global crisis and impose more constraint on liquidity portfolio. Majority of banks were focused on expanding their asset as a target and then make controlling on the funds source as necessary. The internal issues that influence corporate governance in banks in Nigeria: weak risk management, difficulty in changing management, conflicts of interest, non-existent dependable mechanisms for obtaining information to the Board, and unclear pay of directors.
(Al-Tamimi & Al-Mazrooei , 2007)	8 national conventional and 5 foreign conventional banks 4 Islamic banks in UAE	2006	Questionnaire survey	Three most crucial risk types that UAE commercial banks are facing namely: foreign exchange risk, credit risk, and operating risk. The large majority of the banks (90%), the four most crucial risk identification methods are as follows: inspection by risk manager of the bank, audits, analysis of financial statements, and risk survey. the UAE commercial banks are efficiently assessing and analysing risk They use a quantitative and qualitative analysis methods, the assessment of the costs and benefits of addressing risks, and the prioritizing of risks to assessment and the risks . the UAE commercial banks have an efficient risk monitoring and controlling system. The national and foreign banks of UAE significantly differ in terms of their risk assessment practice and analysis, and in their risk monitoring and controlling. the practices of risk management are primarily impacted by specific factors including economic conditions, competition and regulations.
(Mokni, et al., 2015)	24 conventional and 23 Islamic in MENA area	2012-2013	Questionnaire survey	The credit risk is the most crucial, while liquidity risk was the second most crucial in both types of banks. Banks have a committee/section responsible for identifying, monitoring, and controlling different risks. Both types of bank rely on the traditional credit risk mitigation tools. Analysing type of depositors, withdrawing factor, as a Procedures to manage liquidity risk. Funds in central banks used for managing liquidity

				risk, followed by cash reserve in both types of banks. Islamic banks do not use the more technically advanced risk measurement approaches in monitoring market risk as those used by conventional counterparts .There was no differences in risk perception between both types of bank particularly with respect to liquidity risk, foreign exchange risk and operational risk. However, there difference for both credit risk and market risk.
(Abu Hussain & Al-Ajmi, 2012)	8 conventional, 4 Islamic, and 5 leading foreign banks in Bahrain	2009-2010	Questionnaire survey	Credit risk, is the first important risks, Liquidity risk ranked as the second most important risk. The bank risk staff, audit and physical inspection and financial statement analysis as the three methods most widely used to identify types of risks in Bahrain banks. Bankers believe that banks operating in Bahrain have efficient Risk monitoring and control system. The risk levels Islamic banks were facing were considerably higher as opposed to those that conventional banks were facing. Depositories should expect to receive higher rate because the Islamic banks face higher risks over all. In addition, the borrowers will pay more interest because the Islamic banks share the asset risk with them.
(Selma , et al., 2013)	16 Tunisian banks	2012	Questionnaire survey	The collateral and guarantees is most popularly employed methods of credit risk mitigation. Strengthen liquidity risk management function and Diversified funding sources and improving treasury and ALM systems and Revise contingency funding plan (CFP) appear as a tools in managing liquidity risks .Analysing the type of depositors, withdrawing factors and type of deposits, tenor and monitoring and evaluation as a procedures used to manage liquidity risk in the Tunisian banks . The stress tests were used for reporting to board of directors and senior management. Most of the Tunisian banks continue to rely on traditional methods to mitigate credit risk such as collateral. The internal audit one of the most used tools to mitigate the operational risk in the banks sample .The Tunisian banks not used value at risk (VAR) in extensively in the type of market risk.
(DeYoung & Yom, 2008)	US commercial banks	1990-2005	canonical correlation analysis	The developments of the banks activities and a strong supervisory safety may have caused the decreased need for banks to practice strict ALM. The financial innovation expand the methods that used by bank to manage their risks. Weaker relationship between asset and liability among banks that intensively employ strategies of risk mitigation.
(Kosmidou & Zopounidis, 2004)	Greek commercial bank.	1999-2000	Goal programing and simulation analysis	The market trend and the frequent fluctuations of the market rates emphasize the need for all financial institutions to have an ALM system, which can use an accurate representation of their current position and the favourable scenarios later. The current strategy for the Greek banks it is not optimal and they need to re-evaluate their present policies.
(Tektas, 2005)	Two Medium-scale Turkey commercial banks	1999-2000	Goal programing	They concentrating on the banks' program goals, liquidity, capital adequacy ratio, deposits and loans market share, and revenues. Optimistic and pessimistic scenarios were run in the optimistic scenario, the two banks are assumed to accomplish the prescribed goals in the program. On the other hand, in the pessimistic scenario, the banks are expected to accordingly adjust their balance sheet.
(Kosmidou, et al., 2004)	36 Domestic banks 44 foreign banks in UK	1996–2002	Statistical cost accounting method.	They found disparity in the banks' returns and linked it to the difference in the composition of asset-liability between foreign and domestic banks, suggested paying more attention to liability management as opposed to asset management. In addition, how and where the management should allocate its time and devotion for improve the performance.
(Shrestha, 2015)	7 commercial banks in Nepal	2007-2014	pooled OLS regression analysis	Positive rate of ROA and the rate differs based on assets. On the other hand, The cost rate on liabilities appears to be negative and the rate differs based on liabilities. The GDP and Inflation rate as the macroeconomic variables that negatively affect the profitability of Nepal commercial banks, the banks need focusing on increasing the public awareness for the attainment of greater saving and fixed deposits, as this will consequently improve banks' performance in providing loans.
(Tee, 2017)	Listed Banks in Ghana	2008-2012	multiple linear regression	A significant negative impact of total liabilities (fixed deposits and saving) on commercial banks' profitability. Total bank asset had a positive significant effect on Ghana banks profitability. Real Interest rate as one of the macroeconomic variables imparted no significant impact on commercial banks' profitability. While general rate of inflation had a negative effect on profitability.

(Chatterjee & Dutta, 2016)	20 Private and 26 public commercial banks in India	2005-2013	panel data regression (fixed and random effect)	The low-profit banks had greater return rate on loans and advances, fixed assets. Lower rates of return on deposits placings to banks as opposed to the high-profit counterparts. Moreover, the high-profit banks had the lowest cost rate on other funding. Whereas for the low-profit counterparts, 'short-term funding' appeared to be the cheapest funding source. The negative impact of the level of non-performing assets on profitability for both.
(Meena, & Dhar, 2014)	Three banks from public, private and foreign banks in India	2002-2011	Analysis of maturity gap	All banks are financing their short-term liabilities using their long-term assets. The amount of cash that banks were keeping could cause issues in the long run because such practice appears to be weakening the profits of these banks. The practices of ALM are entirely dictated by banks' management. The gap between RSA and RSL positive in buckets less than 29 days that banks not taking risks on short-term liquidity positions.
(Novickytėa & Petraitytėa, 2014)	commercial banks and foreign banks branches in Lithuania	fourth quarter of 2000 to the second quarter of 2013	X12-ARIMA analysis tool pack	The share of loans in total assets ratio is more sensitive to the economic cycles than the deposit. Banks appear to be managing their assets and liability while also trying to impact both their activity and profitability. The moral hazard is apparent in Lithuanian financial sector as the most risky balance sheet items change in risk-free manner after the Bank of Lithuania deploys conservative measures. The financial sector appeared to be more inclined to take more risk in ALM when there was economic upturn.
(Suresh & Krishnan, 2018)	Two public and two private banks in India	2007-2008 2016-2017	Gaps analysis	The public banks had negative mismatches in short term and in medium term. This attitude will effect on the income interest in case increasing in the interest rate. While in long term had a positive Gap .NPA in public banks higher than the private banks, might effect on their profitability. Private banks had positive gap in most of the period of the study, both types of bank nee to control on the mismatches. To avoid any liquidity problem in short or long term.
(Dash & Pathak , 2011)	Among 57 public, private, and foreign banks in India	2007-2008	linear programming model	The procedure of ALM used by Indian public banks appeared to be better and more diversified, and this finding has been linked to the composition of banks. The ownership and the structure of the banks have effect on the ALM procedure. Thirty percent of the sample in public sector exposed to interest rate risk. The Indian banks should careful maintenance and monitoring of positions of asset-liability, and balancing of profitability, liquidity as well as interest rate risk.
(Mun & Thaker, 2017)	six Conventional and six Islamic banks in Malaysia	2010-2013	ANOVA	ALM had a significant effect on the profitability for two types of banks. The management efficiency, liquidity ratio, degree of risk aversion insignificant in both of banks. The asset quality variables negative in Conventional while positive in Islamic banks with profitability .Noted the difference in findings for both bank types, and this difference was attributed to the different operation method employed by each type of banks.
(AL-Mutairi & Naser, 2015)	47 commercial banks listed in GCC	2001-2010	Regression model	Most of the banks in GCC under the sample were financed by debts, and this actually accounted for more than 80% these banks' capital. The profitability affect the capital structure decision. The ROA, tangibility asset and size, had a negative and statistically significant relationship between the capital structure of GCC banks and their profitability. Negative relationship between bank size and leverage. This may suggest that the smaller the bank in terms of total assets, the more outsource fund will be use. While a positive and statistically significant linkage between capital structure and age and growth in GCC banks.

Appendix 2:

Appendix 2-1: Letter written to the surveyed bank

2017

Dear Sir/ Madam,

I would like to invite you to participate in my research about the Asset Liability Management (ALM). I am aware of the tremendous business pressure and the limited availability for accepting my request, but I kindly request your participation noting that it would not take more than 35 minutes from your time to answer this questionnaire. Your contribution will be an important part of my PhD research project which is carried out in Lord Ashcroft International Business School, Anglia Ruskin University.

Please refer to the questionnaire attached to this letter about the objectives of the survey and as well as instructions for answering the questionnaire. Finally, I would like to thank you for your kind cooperation and assure you that data and opinions provided will be treated with strict confidentiality.

Sincerely yours,

Ahmad Al-Naimi, PhD candidate
Lord Ashcroft International Business School
Anglia Ruskin University

Appendix 2-2: Survey Questionnaire

Questionnaire on Asset Liability Management in Jordanian commercial banks

Lord Ashcroft International Business School

Anglia Ruskin University

2017

This questionnaire survey was established as a part of a project for the award of PhD in finance.

Preface

The Asset Liability Committee (ALCO) plays a key management function that spans the entire financial institutions by assisting the Board of Directors (BoDs) to assess the adequacy of the Asset Liability Management (ALM) policy and monitor the implementation of ALM and related procedures.

This questionnaire is designed to describe the current Asset Liability Management (ALM) framework for commercial banks in Jordan.

The samples will constitute of all commercial banks operating in Jordan. There are no right or wrong answers. Your replies will be anonymous and all information provided in this questionnaire will be treated in strict confidence.

If you would like further information about the questionnaire, please do not hesitate to contact Ahmad Al-Naimi (email: ahmad.al4@pgr.anglia.ac.uk) at Anglia Ruskin University, the United Kingdom.

Conceptual Framework

The following section contains basic definitions that survey respondents should consider while answering the questionnaire. These definitions, based on Choudhry (2011)[30], have been carefully selected to create a common level of understanding and ensure consistency.

Asset Liability Committee (ALCO): A committee, established within the organizational structure of the bank that oversees all aspects of asset liability management through formulating ALM policies and ALM reporting strategies. In addition, the committee oversees liquidity and funding management, formulating hedging policy, transfer-pricing system, and interest rate risk exposure management, etc.

Asset Liability Management (ALM): The processes that provide the decision makers with a wide variety of strategies and risks that should be considered to maximize the earnings and the value of the bank by managing the entire balance sheet.

Contingency Funding Plan (CFP): Strategies that address liquidity shortfalls in emergency situations and identify sources of potential liquidity strain to ensure that current exposures remain in accordance with a bank's established liquidity risk tolerance.

Credit Risk: The risk of loss of principal and/or loss of interest due to a borrower's failure to repay a loan or otherwise meet a contractual obligation.

Hedging: An investment made to reduce the risk exposure of price movements in assets or liabilities.

[30] Choudhry, M., 2011. An introduction to banking: liquidity risk and asset-liability management (Vol. 30). John Wiley & Sons.

Interest rate risk: The potential impact of changes in interest rates on the net asset value of a financial institution's balance sheet and earnings resulting from interest rates changes.

Liquidity Risk: The uncertainty surrounding the speed and the availability of convertibility with the presence of a readily market where assets can be active traded.

Liquidity Management: The ability of the bank to meet its obligations as they fall due, depending on the condition of the macroeconomic environment, sector and entity specifics.

Liquidity stress testing: A pack of tools that are used in assessing the ALM sensitivities and vulnerabilities to changing economic conditions on both the back book and planned future business.

Market risk: The probability of incurring losses due to changes in overall financial market factors.

Instructions for completing the Questionnaire

Please read the following instructions before starting to answer the survey questions:

Each Question requires one answer only, unless otherwise specified.

If you do not understand a question or it is unclear please omit the question and move on to the next.

Some questions may require to provide an opinion. Please fill it in the designated area.

Some questions provide flexibilities to offer your own answer, shown as 'Other'. If you choose 'Other', please specify in the designated area.

Please read the questions carefully in the questionnaire and provide the most accurate answers. This questionnaire will take less than 30 minutes.

Questionnaire on Asset Liability Management

Part I: Basic Information

1.1 Name of the Bank:

1.2 The Position of the respondent:

1.3 Department/ Unit:

1.4 Telephone Number:

1.5 Gender:

1.6 Age:

- Less than 25
- 25-40
- 41-54
- 55 and over
- I prefer not say

1.7 Educational Level:

- High School
- Diploma
- Bachelor Degree
- Post Graduate

1.8 Working Experience:

- Less than five years
- Five to ten years
- Ten to fifteen years
- More than fifteen years

Part II: Organizational structure

2.1 Which department in your bank is responsible for managing assets and liabilities?

- Finance Dep.
- Treasury Dep.
- Risk Management Dep
- Other, please specify (……)

2.2 Do you have an Asset Liability Committee (ALCO)?

Yes No

2.3 Please tick ALL the positions that are represented in the ALCO of your bank:

CEO Head of corporate banking

Head of treasury Head of SMEs banking.

Head of risk management Head of compliance Department

Head of retail banking Head of Internal Audit Department

Head of Finance Other, please specify (…….)

Part III: Asset Liability Management (ALM)

3.1 Do you have an Asset Liability Management (ALM) process?

Yes

No

3.2 What are the aims of the ALM in your bank?

3.3 Please rank the following risk exposures according to their order of importance in your ALM process (Please fill with (X) if a type of risk isn't covered at your ALM process):

( ) Interest rate risk ( ) Liquidity risk

( ) Credit risk ( ) Operations risk

( ) Foreign exchange risk ( ) Market risk

3.4 Which areas are covered by the ALM policies at your bank? Please tick all that apply.

Investment and hedging strategies | New product approval

Methodology for measurement of risks | Limit setting and control

Other, please specify (…….)

3.5 Please choose the management tools used in the ALM process at your bank.

Duration matching | Efficient frontier Analysis

Cash flow matching | Description

Asset/liability Projections | Other, please specify (……..)

3.6 How often your bank assess ALM strategies?

Daily | Yearly

Weekly | Occasionally

Monthly | Other, please specify (…….)

Quarterly

3.7 To what extent do you agree with the following statement? Please tick one numeric value corresponding to your opinion for each statement (number '5' represents 'Strongly agree', while number 1 represents 'Strongly disagree')

Statement	Strongly agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly disagree (1)
The ALM strategy is set by ALCO.					
ALM strategy is set in accordance with the overall strategic objectives of the bank and disseminated throughout the bank.					
ALM strategy is consistent with the operational objectives and takes into account the balance sheet structure, and the status of different product lines.					

The ALM is a dynamic process that is based on analysing, assessing, and reviewing the effectiveness of the set strategies based on reports and findings.					
The ALM strategy considers the potential impact on non-quantifiable risks.					
Risk exposure limits are set based on the overall strategy of the bank in a way that takes product line levels into consideration.					
ALM process incorporates operational, credit and market risks, as well as formulates risk exposure strategies and sets limits.					

Part IV: ALCO committee

4.1 Please choose all the functional scope of risks that ALCO considers at your bank?

Liquidity Risk Operational Risk

Interest Rate Risk Exchange Rate Risk

Credit Risk Other, please specify (…….)

Market Risk

4.2 Please tick the frequency of ALCO meetings:

Daily Yearly

Weekly Occasionally

Monthly Other, please specify (…….)

Quarterly

4.3 What Reports are provided to ALCO at your bank?

4.4 Is ALCO responsible for setting risk metrics?

Yes No

4.5 If your answer is (Yes), please indicate whether the risk metrics cover the following types of risk:

Liquidity Risk ……

Interest Rate Risk ……

Credit Risk ……

Market Risk ……

Other, please specify ……

4.6 Is ALCO responsible for setting risk exposure limits?

Yes No

4.7 Who will review ALCO report? Please choose all that apply:

Board of Directors Central Bank

CEO Other, please specify (……..)

Shareholders

4.8 How often ALCO report is reviewed at your bank?

Daily Yearly

Weekly Occasionally

Monthly Other, please specify (…….)

Quarterly

4.9 To what extent do you agree with the following statement? Please tick one numeric value corresponding to your opinion for each statement (number '5' represents 'Strongly agree', while number 1 represents 'Strongly disagree')

Statement	Strongly agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly disagree (1)
Liquidity reports provided to ALCO contain risk exposures, funding liquidity plans, and other.					
ALCO report must focus on proposing strategies that could enhance the performance in the future.					
ALCO report focuses on the overall performance of the bank and business level.					
The Board of Directors are responsible for adopting the proposed strategies in the ALCO report.					
A periodic review is conducted for reviewing the performance of adopted strategies.					
The Central bank effectively supervises ALCO decisions at your bank.					

Part V: Liquidity Risk

5.1 Which department is responsible for managing liquidity risk?

Finance Dep. Treasury Dep.

Risk Management Dep

Other, please specify (……)

5.2 How does your bank quantify liquidity risk and funding risk?

5.3 How the limits of liquidity risk and funding risk are set?

5.4 How often your bank monitor liquidity positions:

Daily

Weekly

Monthly

Quarterly

Yearly

Occasionally

Other, please specify (…….)

5.5 What are the tools used for assessing liquidity risk at your bank?

Liquidity metrics

Contractual Maturity Mismatch

Concentration of funding

Available Unencumbered Assets

Market-related monitoring tools

Other, please specify (…….)

5.6 How your bank deals with a shortage in liquidity positions at your bank? Please tick all that apply.

Additional borrowing Inter-bank market

Lender of Last resort (CBJ) Other, please specify (…….)

Secondary markets

5.7 Capital is considered as one of the means that can be used to correct/ mitigate liquidity risk exposure:

Yes No

5.8 Do you consider funding liquidity as a type of risk that banks are exposed to?

Yes No

5.9 What measures that your bank will use to avoid the Funding Liquidity risk at your bank?

5.10 Please rank the following form of funding liquidity risk according to their order of importance to your bank (‘1’ stands for most important, ‘3’ stands for less important):

( ) Margin funding risk ( ) Redemption risk

( ) Rollover risk

5.11 Does your bank have Liquidity technical reserve buffers?

Yes No

5.12 How does your bank determine Liquidity technical reserve volume?

5.13 Who is responsible to determine the Liquidity technical reserve at your bank? Please tick all that apply.

CEO	Head of corporate banking
ALCO	Head of SMEs banking.
Head of treasury	Head of compliance Department
Head of risk management	Head of Finance
Head of retail banking	Other, please specify (…….)

5.14 To what extent do you agree with the following statement? Please tick one numeric value corresponding to your opinion for each statement (number '5' represents 'Strongly agree', while number 1 represents 'Strongly disagree')

Statement	Strongly agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly disagree (1)
Liquidity risk management is consistent with the overall strategy of the bank.					
Liquidity risk is set according to the institutional and department level.					
Liquidity risk exposure limits are set while considering the operational liquidity needs.					
Implementation of Basel III enhances liquidity risk management.					
Implementation of Basel III adds additional strains on banks' ability to make structural changes in liquidity positions.					

Contingent liquidity needs are taken into consideration while setting up liquidity risk exposures.					
Financial derivatives are used as tools to manage liquidity risk.					

Part VI: Interest rate risk

6.1 How does your bank quantify interest rate risk?

6.2 How you measure the Target of Interest Rate Margin?

6.3 What techniques that your bank uses to manage interest rate risk:

Gap analysis (RSAa,RSLs) simulation

maturity ladder Other, please specify (…….)

6.4 What methods your bank uses to reduce interest rate risk? Please tick all that apply.

Maturity matching of loans and deposits Interest rate swaps

Floating-rate loans Interest rate caps

Other, please specify (…….) Interest rate future contracts

6.5 Does your bank use off-balance Instruments to manage interest rate mismatches?

Yes No

6.6 If your answer was (yes), please specify the prevailing types of instruments?

Part VII: Credit risk

7.1 How does your bank Quantify credit risk?

7.2 What methods that your bank uses to reduce credit risk? Please tick all that apply.

Determining customer credit worthiness Credit rationing

Loan commitment Collateral

Other, please specify (…….)

7.3 Does your bank use off-balance sheet instruments to manage credit risk (such as credit derivatives)?

Yes No

7.4 If your answer was (Yes), please specify the prevailing type of instruments?

Part VIII: Market risk

8.1 How does your bank quantify market risk?

8.2 What methods your bank uses to reduce market risk? Please tick all that apply.

Avoiding high exposure positions. Monitoring macro-financial indicators

Take offsetting trading positions. Other, please specify (…….)

Part IX: Contingency Funding Plans (CFP) and stress testing

9.1 Does your bank have a CFP?

Yes No

9.2 Does your bank review CFPs on a regular basis?

Yes No

9.3 If your answer is (Yes), please indicate the frequency of reviewing your CFPs:

Daily Yearly

Weekly Occasionally

Monthly Other, please specify (…….)

Quarterly

9.4 Does your bank perform stress testing on a regular basis?

Yes No

9.5 If your answer is (Yes), please indicate the frequency of performing stress testing at your bank:

Daily Yearly

Weekly Occasionally

Monthly Other, please specify (…….)

Quarterly

9.6 To what extent do you agree with the following statement? Please tick one numeric value corresponding to your personal opinion for each statement (number '5' represents 'Strongly agree', while number 1 represents 'Strongly disagree')

Statement	Strongly agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly disagree (1)
A bank should develop an effective CFP to account for the outcome of alternative scenarios on liquidity positions and on risk mitigation factors.					
An effective CFP should contain strategies to deal with liquidity shortfalls and ensure the availability of sufficient liquidity resources to meet its obligations.					
CFP should be reviewed on a regular basis to ensure that it remains operationally robust.					
CFP must take into account market liquidity conditions, operational constraints, the ability to raise funding, lender of last resort, and the consequences results from applying the plan itself.					
CFP is concerned with low-probability and high-impact events that could negatively affect the available liquidity resources.					
Stress testing should consider alternative scenarios on liquidity positions, risk mitigation, off-balance sheet items, contingent liabilities, and must review the assumptions underlying decisions concerning funding position.					
Stress testing should be performed on a regular basis to identify resources of liquidity stress and to ensure the adherence of the bank's units to risk exposure limit guidelines.					
Stress testing should analyse the separate and combined impact of liquidity stress on cash flow, liquidity position, profitability, and solvency.					
Stress testing should take market conditions, correlation between funding markets, and the scale of complexity in business activities.					
Stress tests should highlights vulnerabilities in the banks positions and propose remedial action.					

Stress tests results should be integrated into day-to-day risk management. In addition, its results should be taken into consideration while setting risk exposure limits.					

End of questionnaire.

Thank you for your time and cooperation.

Appendix 2-3: The Survey Questionnaire Sample

As mentioned above the survey questionnaire sample will consist of the following operating domestic and foreign banks in Jordan:

No.	Domestic Banks	No.	Foreign Banks
1	Arab Bank PLC	1	Egyptian Arab Land Bank
2	Jordan Ahli Bank PLC	2	Rafidain Bank
3	Bank of Jordan PLC	3	Citibank N.A.
4	Cairo Amman Bank	4	Standard Chartered Bank
5	The Housing Bank for Trade and Finance	5	National Bank of Kuwait
6	Jordan Kuwait Bank	6	Banque Audi SAL
7	Jordan Commercial Bank	7	BLOM Bank
8	Arab Jordan Investment Bank	8	National Bank of Abu Dhabi
9	Arab Banking Corporation (Jordan)		
10	Investment Bank		
11	Union Bank		
12	Societe Generale De Banque-Jordanie		
13	Capital Bank of Jordan		
Total Banks in the sample		**21 Banks**	

Appendix 3:

Table 38: Main studies that investigated profitability and liquidity risk

Authors/ Year	Country	Period	Methodology	Findings
(Staikouras & Wood, 2004)	European banking sector	1994–1998	Fixed effect estimator	A negative impact of risk on bank profitability
(Sufian, 2011)	Korean banking sector	1986–1995	Fixed effect estimator	A negative impact of risks related to bank profitability while concentration has positive effect on profitability
(Bonner, et al., 2015)	OECD Countries	1998-2007	OLS with a dynamic GMM panel estimator	Institution's Profit and Capital ratio has moderate effects on the size of its liquidity buffer; its Deposits from clients have a large impact. Likely attributable to a lack of funding diversification
(Al-Jafari & Alchami, 2014)	Syrian banking sector	2004-2011	GMM estimator	Liquidity risk has a negative impact on profitability as higher liquidity risks result in lower profits
(Dezfouli, et al., 2014)	Iranian Banking system	2005-2011	Four-step econometric model and GMM linear forecasting model	Higher liquidity holdings in banks increase their costs at times of inflation which reduces their profitability.
(Pagratis, et al., 2017)	U.S. commercial banks	2002:Q1–2009:Q1	Stochastic dominance efficiency methods	Small banks seem to have a higher target for net interest margin than large banks, possibly due to higher dependence of small banks' core profitability on net interest income. Also, US commercial exhausted their ability to self-insure against liquidity shocks, implying that the lender of last resort functions as indispensable.
(Wójcik-Mazur & Szajt, 2015)	Nineteen advanced economies' commercial banks	1994-2006	2SLS estimator	A positive, long-term relation between liquidity risk and interest rate margin ratio
(Molyneux &	Eighteen European countries	1986-1989		A weak inverse relationship with profitability is also to be expected as liquidity holdings (particularly

Thornton, 1992)				those imposed by the authorities) represent a cost to the bank.
(Sufian & Chong, 2008)	Philippines banking sector	1990-2005	Fixed and random effects estimator	Risk is negatively related to bank profitability
(Barth, et al., 2003)	2300 banks in 55 countries	(supervision)		The liquidity ratio is negatively related to ROA.
(Demirgüç-Kunt & Huizinga, 2010)	International sample of 101 countries and 1334 banks	1995-2007	Fixed effect estimator	Banks that hold a high fraction of liquid assets have lower net interest margins, which are consistent with banks receiving lower returns on holding cash or securities, but are facing a competitive market for deposits.
(Kosmidou, 2008)	23 banks in Greece	1990-2002	Fixed effect estimator	The liquidity ratio is negatively related to return on average assets (ROAA).
(Bourke, 1989)				The liquidity ratio is positively related to return on assets (ROA).
(Demirgüç-Kunt & Huizinga, 1999)	80 countries	1988-1995	Fixed effect estimator	Liquidity ratio negatively affects ROA and positively affects NIM

Table 39: Main studies that investigated the effects of credit risk on liquidity risk

Authors/ Year	Country	Period	Methodology	Findings
(Roulet, 2018)	European commercial banks from 22 countries	2008-2015	OLS estimator	Liquidity ratios has a significant and positive impact on commercial-lending-growth for large and small European banks
(Acharya & Viswanathan, 2011)	Iranian Banking sector	2005-2012	A benchmark model of risk-shifting and asset sales	A significant positive impact between credit risk and liquidity risk
(Ejoh, et al., 2014)	Nigerian Banks	Survey (80 respondents)	Pearson product moment correlation and chi-square statistical tool	A positive relationship between liquidity risk and credit risk
(Ghosh, 2016)	GCC banking sector	1996-2012	3SLS estimation	A positive relationship between liquidity risk and credit risk
(Berger & Bouwman, 2009)	U.S. Commercial banks	1993-2003	Fixed effect estimator	Liquidity indicators have positive but perverse effects on bank-lending-growth
(Imbierowicz & Rauch, 2014)	U.S. Commercial banks	1998:Q1 to 2010:Q3	3SLS	There is no economically meaningful relationship between liquidity risk and credit risk

(Kim & Sohn, 2017)	U.S. Commercial banks	1993-2010	Fixed effect estimator	The interaction between credit risk and liquidity risk is negligible for small and medium banks but is significantly positive and prominent for large banks

Table 40: Main studies that investigated the effects of bank size on liquidity risk

Authors/ Year	Country	Period	Methodology	Findings
(Acharya & Merrouche, 2012)	UK Banks	02 January 2007 to 30 June 2008	2SLS estimator	Small banks' borrowing cost is significantly dependent on the variations in their own liquidity buffer while this is not the case for large banks.
(Kim & Sohn, 2017)	U.S. Commercial banks	1993-2010	Fixed effect estimator	The effect of an increase in capital ratio on credit growth is significantly negative for low liquidity ratios, and the effect becomes significantly positive only after large banks retain sufficient liquid assets.
(Roman & Sargu, 2015)	CEE countries	2004-2011	OLS estimator	Size effects on the overall liquidity are mixed.
(DeYoung & Jang, 2016)	U.S. Commercial banks	1992-2012	GMM estimator & OLS estimator	As banks increase in size, they set lower liquidity targets and manage them more efficiently.

(Vodova, 2011)	22 Czech commercial banks	2006-2009	Fixed effects estimator	Liquidity ratios have a positive relationship with size and capital.
(Bonner, et al., 2015)	7000 banks from 30 OECD countries	1998-2007	Pooled OLS estimations with robust standard errors	The relationship between bank liquidity buffers with bank size is substantially weaker in countries with bank liquidity regulations.
(Laeven, et al., 2016)	412 deposit-taking institutions from 56 countries	2006-2008	Fixed effects estimator	Systemic risk increases with bank size.
(Hughes & Mester, 2013)	842 top-tier bank holding companies in the US	2007	2SLS and GMM estimator	Scale economies exist at smaller banks and are even larger at large banks.
(Altunbas, et al., 2007)	Banks in 15 European countries	1992-2000	Seemingly Unrelated Regression (SUR) approach	There are strong positive relationships between liquidity and risk as banks with higher liquidity levels have higher reserve levels.
(Aspachs, et al., 2005)	57 UK resident banks	1985Q1 - 2003Q4	Fixed effect estimator	There is insignificant effect of size on banks' holdings of liquid assets.

Table 41: Main studies that investigated the effects of capital on liquidity risk

Authors/ Year	Country	Period	Methodology	Findings
(Roulet, 2018)	European commercial banks from 22 countries	2008-2015	OLS estimator	Capital ratios have significant negative impact on large European retail lending growth and other types of lending over the post 2008 financial crisis period.
(Kim & Sohn, 2017)	U.S. Commercial banks	1993-2010	Fixed effect estimator	An increase in bank capital on credit growth is positively associated with the level of bank liquidity only for large banks
(Roman & Sargu, 2015)	CEE countries	2004-2011	OLS estimator	There is a positive link between the ROAE indicator and the liquidity indicator
(Vodova, 2011)	22 Czech commercial banks	2006-2009	Fixed effects estimator	Increases in capital adequacy have a positive impact on bank liquidity
(Bonner, et al., 2015)	7000 banks from 30 OECD countries	1998-2007	Pooled OLS estimations with robust standard errors	The relationship between bank liquidity buffers with bank size is substantially weaker in countries with bank liquidity regulations
(Laeven, et al., 2016)	412 deposit-taking institutions from 56 countries	2006-2008	Fixed effects estimator	Systemic risk is lower in more-capitalized banks, with the effects particularly more pronounced for large banks
(Pagratis, et al., 2017)	U.S. commercial banks	2002:Q1–2009:Q1	Stochastic dominance efficiency methods	Capital adequacy targets are higher for smaller banks as they have larger Tier I ratio and that precautionary high liquid assets buffers are important for banks to perform their maturity transformation role.

Table 42: Main studies that investigated the effects of other factors on liquidity risk

Authors/ Year	Country	Period	Methodology	Findings
(Almeida, et al., 2004)	U.S Firms	1971-2000	Fixed effect estimator	Financially constrained firms have a higher propensity to save cash.
(Bonner, et al., 2015)	7000 banks from 30 OECD countries	1998-2007	Pooled OLS estimations with robust standard errors	Complementarity of disclosure and liquidity requirements provides a strong rationale for considering them jointly in the design of regulation.
(Ratnovski, 2013)	------	------	A model of bank liquidity risk	liquidity Requirements should be complemented by measures that increase bank incentives to adopt transparency.
(Resti, 1997)	Panel sample of 270 Italian banks	1988-1992	DEA and SFA	There is a direct relationship between productive efficiency and asset quality.
(Aspachs, et al., 2005)	57 UK resident banks	1985Q1 - 2003Q4	Fixed effect estimator	The increased probability of banks receiving the lender of last resort support will decrease their liquidity holdings

Appendix 4:

Model (1) results

Dependent Variable (LTD)	OLS	RE	FE
Internal Factors			
Profitability			
ROAA	0.06*	0.109***	0.118***
Capital			
TCR	-0.119	-0.033	0.020
Quality of Management			
CTIR	-0.0003	0.004**	0.003**
Bank Size			
MARS	-0.0721***	-0.098***	-0.028**
Credit risk			
LOLTA	0.055*	0.030	0.009
Control Variables			
RRR	0.395***	0.393***	0.305***
IBR	0.080*	0.082**	0.075***
M2GDP	-0.004	-0.004	-0.004
Dummy Variables			
DARS	0.052	0.082**	0.085***
Constant	4.222***	3.966***	3.481***
Robustness tests			
F-statistic	4.288***	4.955***	15.191***
R^2	0.21	0.234	0.704
JB-Test	0.490	0.820	2.162
Heteroscedasticity test	5.871***	4.040***	1.684
VIF	1.265	1.305	3.38
Redundant fixed effects	-----	-----	15.484***
Hausman test	-----	13.63	-----
Wooldridge serial corr.	28.018***	13.619***	0.498
No. observations	156	156	156

This table report the results of the first model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (2) results

Dependent Variable (LTD)	OLS	RE	FE
Internal Factors			
Profitability			
ROAA	0.060*	0.107***	0.117***
Capital			
TIER1	-0.347*	-0.005	0.174
Quality of Management			
CTIR	-0.0006	0.004**	0.003**
Bank Size			
MARS	-0.073***	-0.094***	-0.024
Credit risk			
LOLTA	0.055*	0.033	-0.011
Control Variables			
RRR	0.406***	0.391***	0.295***
IBR	0.081*	0.082**	0.071***
M2GDP	-0.004	-0.004	-0.004
Dummy Variables			
DARS	0.055	0.082**	-0.085**
Constant	4.242***	3.842***	3.342***
Robustness tests			
F-statistic	4.333***	4.905***	15.142***
R^2	0.211	0.232	0.703
JB-Test	0.731	0.793	2.246
Heteroscedasticity test	5.653***	5.61***	1.723
VIF	1.267	1.302	3.367
Redundant fixed effects	-----	-----	15.342***
Hausman test	-----	32.74***	-----
Wooldridge serial corr.	31.947***	31.947***	0.974
No. observations	156	156	156

This table report the results of the second model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (3) results

Dependent Variable (LTD)	OLS	RE	FE
Internal Factors			
Profitability			
ROAA	0.035	0.058*	0.062**
Capital			
EQTA	0.029***	0.026***	0.026***
Quality of Management			
CTIR	0.002	0.004***	0.003***
Bank Size			
MARS	-0.048***	-0.067**	-0.018
Credit risk			
LOLTA	0.107***	0.038	0.009
Control Variables			
RRR	0.269***	0.222**	0.162***
IBR	0.050	0.059*	0.049**
M2GDP	-0.000	-0.000	-0.001
Dummy Variables			
DARS	0.027	0.048	0.056**
Constant	3.352***	3.528***	3.307***
Robustness tests			
F-statistic	8.044***	8.717***	20.479***
R^2	0.331	0.349	0.762
JB-Test	1.473	1.776	0.978
Heteroscedasticity test	3.376***	3.892***	1.994
VIF	1.494	1.536	4.201
Redundant fixed effects	-----	-----	16.842***
Hausman test	-----	3.87	-----
Wooldridge serial corr.	19.944***	15.231***	1.093
No. observations	156	156	156

This table report the results of the third model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (4) results

Dependent Variable (LTD)	OLS	RE	FE
Internal Factors			
Profitability			
ROAE	-0.022	0.042**	0.033
Capital			
TCR	-0.114	0.012	0.042
Quality of Management			
CTIR	-0.002	0.002**	0.001
Bank Size			
MARS	-0.073***	-0.0989***	-0.037
Credit risk			
LOLTA	0.053*	0.0278	0.004
Control Variables			
RRR	0.351***	0.381***	0.293***
IBR	0.095**	0.099***	0.092***
M2GDP	-0.002	-0.003	-0.003
Dummy Variables			
DARS	0.047	0.0862**	0.090**
Constant	4.379***	3.821***	3.522***
Robustness tests			
F-statistic	3.974***	3.558***	13.194***
R^2	0.196	0.179	0.674
JB-Test	0.121	0.596	1.669
Heteroscedasticity test	6.802***	4.601***	2.33**
VIF	1.243	1.218	3.067
Redundant fixed effects	-----	-----	12.961***
Hausman test	-----	11.22**	-----
Wooldridge serial corr.	37.077***	26.433***	4.393
No. observations	156	156	156

This table report the results of the fourth model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (5) results

Dependent Variable (LTD)	OLS	RE	FE
Internal Factors			
Profitability			
ROAE	-0.023	0.042**	0.039
Capital			
TIER1	-0.340**	0.123	0.268**
Quality of Management			
CTIR	-0.001	0.002**	0.001
Bank Size			
MARS	-0.074***	-0.094***	-0.034
Credit risk			
LOLTA	0.053*	0.030	0.007
Control Variables			
RRR	0.360***	0.377***	0.285***
IBR	0.096***	0.098***	0.086***
M2GDP	-0.002	-0.003	-0.003*
Dummy Variables			
DARS	0.050*	0.085**	0.091***
Constant	4.409***	3.696***	3.331***
Robustness tests			
F-statistic	4.022***	3.575***	13.071***
R^2	0.198	0.181	0.671
JB-Test	0.204	0.584	1.711
Heteroscedasticity test	6.749***	4.730***	2.326*
VIF	1.246	1.221	3.039
Redundant fixed effects	-----	-----	12.748***
Hausman test	-----	12.97	-----
Wooldridge serial corr.	41.668***	26.012***	0.459
No. observations	156	156	156

This table report the results of the fifth model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (6) results

Dependent Variable (LTD)	OLS	RE	FE
Internal Factors			
Profitability			
ROAE	0.040	0.055**	0.043**
Capital			
EQTA	0.032***	0.030***	0.030***
Quality of Management			
CTIR	0.002***	0.004***	0.004***
Bank Size			
MARS	-0.048***	-0.068***	-0.021
Credit risk			
LOLTA	0.108***	0.039	0.009
Control Variables			
RRR	0.275***	0.225***	0.161***
IBR	0.052**	0.062***	0.054***
M2GDP	-0.001	-0.001	-0.001
Dummy Variables			
DARS	0.029*	0.050**	0.056***
Constant	3.223***	3.363***	3.201***
Robustness tests			
F-statistic	8.085***	8.641***	19.677***
R^2	0.332	0.347	0.755
JB-Test	1.519	2.193	0.971
Heteroscedasticity test	3.357***	3.898***	2.163*
VIF	1.497	1.531	4.08
Redundant fixed effects	-----	-----	16.077 ***
Hausman test	-----	12.97	-----
Wooldridge serial corr.	20.652***	17.393***	2.222
No. observations	156	156	156

This table report the results of the sixth model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (7) results

Dependent Variable (LTD)	OLS	RE	FE
Internal Factors			
Profitability			
NIM	0.088***	0.167***	0.169***
Capital			
TCR	-0.118**	-0.048	-0.028
Quality of Management			
CTIR	-0.000	0.002*	0.003***
Bank Size			
MARS	-0.088***	-0.121***	-0.086**
Credit risk			
LOLTA	0.027	0.009	0.005
Control Variables			
RRR	0.246***	0.143***	0.099**
IBR	0.096***	0.109***	0.113***
M2GDP	-0.003	-0.003	-0.002
Dummy Variables			
DARS	0.028	0.029	0.039**
Constant	4.298***	4.044***	3.733***
Robustness tests			
F-statistic	8.143	15.868***	28.668***
R^2	0.334	0.494	0.818
JB-Test	3.162	3.306	1.439
Heteroscedasticity test	2.938***	1.456	1.534
VIF	1.502	1.976	5.495
Redundant fixed effects	-----	-----	23.567***
Hausman test	-----	16.14*	-----
Wooldridge serial corr.	36.852***	11.613***	1.942
No. observations	156	156	156

This table report the results of the seventh model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (8) results

Dependent Variable (LTD)	OLS	RE	FE
Internal Factors			
Profitability			
NIM	0.087***	0.165***	0.168***
Capital			
TIER1	-0.313**	-0.011	0.038
Quality of Management			
CTIR	-0.001*	0.002*	0.003***
Bank Size			
MARS	-0.087***	-0.114***	-0.079**
Credit risk			
LOLTA	0.031	0.012	0.008
Control Variables			
RRR	0.259***	0.143***	0.095***
IBR	0.098***	0.108***	0.111***
M2GDP	-0.003*	-0.003	-0.002
Dummy Variables			
DARS	0.032	0.030	0.039**
Constant	4.268***	3.873***	3.566***
Robustness tests			
F-statistic	8.099***	15.657***	28.709***
R^2	0.333	0.491	0.818
JB-Test	3.20	3.657	1.463
Heteroscedasticity test	2.681***	1.466	1.441
VIF	1.499	1.964	5.495
Redundant fixed effects	-----	-----	24.220***
Hausman test	-----	18.68**	-----
Wooldridge serial corr.	42.418***	13.955***	1.273
No. observations	156	156	156

This table report the results of the eight model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (9) results

Dependent Variable (LTD)	OLS	RE	FE
Internal Factors			
Profitability			
NIM	0.081***	0.139***	0.133***
Capital			
EQTA	0.028***	0.017***	0.017***
Quality of Management			
CTIR	0.002**	0.003**	0.004***
Bank Size			
MARS	-0.064***	-0.088***	-0.047**
Credit risk			
LOLTA	0.081***	0.021	0.0196
Control Variables			
RRR	0.149***	0.079*	0.052
IBR	0.063***	0.086***	0.087***
M2GDP	-0.001	-0.001	-0.001
Dummy Variables			
DARS	0.007	0.015	0.021
Constant	3.417***	3.611***	3.321***
Robustness tests			
F-statistic	12.826	18.266***	33.603
R^2	0.441	0.529	0.840
JB-Test	0.121	2.348	1.265
Heteroscedasticity test	1.667*	1.173	1.459
VIF	1.788	2.398	6.25
Redundant fixed effects	-----	-----	21.167***
Hausman test	-----	9.05	-----
Wooldridge serial corr.	52.108***	34.865***	0.459
No. observations	156	156	156

This table report the results of the ninth model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (10) results

Dependent Variable (LQATA)	OLS	RE	FE
Internal Factors			
Profitability			
ROAA	-0.061	-0.079	-0.091*
Capital			
TCR	0.260***	0.294***	0.441***
Quality of Management			
CTIR	-0.001	-0.002	-0.005**
Bank Size			
MARS	0.124***	0.114***	-0.135*
Credit risk			
LOLTA	0.058	0.079*	0.106***
Control Variables			
RRR	-1.008***	-0.972***	-0.738***
IBR	0.016	0.014	-0.018
M2GDP	0.021*	0.021*	0.013*
Dummy Variables			
DARS	-0.491***	-0.489***	-0.351***
Constant	3.111***	3.124***	4.365***
Robustness tests			
F-statistic	29.094***	30.285***	21.292***
R2	0.642	0.651	0.769
JB-Test	3.223	3.465	2.817
Heteroscedasticity test	2.431**	2.561**	1.727
VIF	2.793	2.865	4.329
Redundant fixed effects	-----	-----	3.964***
Hausman test	-----	20.26**	-----
Wooldridge serial corr.	0.309	0.269	0.864
No. observations	156	156	156

This table report the results of the tenth model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (11) results

Dependent Variable (LQATA)	OLS	RE	FE
Internal Factors			
Profitability			
ROAA	-0.059	-0.079	-0.094**
Capital			
TEIR1	0.728***	0.832***	1.326***
Quality of Management			
CTIR	-0.002	-0.002	-0.004*
Bank Size			
MARS	0.124***	0.113***	-0.149**
Credit risk			
LOLTA	0.056	0.077*	0.104***
Control Variables			
RRR	-1.034***	-0.999***	-0.771***
IBR	0.013	0.010	-0.022
M2GDP	0.022*	0.021*	0.015**
Dummy Variables			
DARS	-0.497***	-0.496***	-0.352***
Constant	3.117***	3.126***	4.362***
Robustness tests			
F-statistic	29.141***	30.342***	22.003
R2	0.642	0.651	0.775
JB-Test	3.038	3.202	2.993
Heteroscedasticity test	2.337**	2.442**	1.556
VIF	2.793	2.865	4.445
Redundant fixed effects	-----	-----	4.226***
Hausman test	-----	21.07**	-----
Wooldridge serial corr.	0.296	0.259	0.974
No. observations	156	156	156

This table report the results of the eleventh model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (12) results

Dependent Variable (LQATA)	OLS	RE	FE
Internal Factors			
Profitability			
ROAA	-0.037	-0.041	-0.018
Capital			
EQTA	-0.019***	-0.018***	-0.023***
Quality of Management			
CTIR	-0.003	-0.003	-0.006**
Bank Size			
MARS	0.092***	0.086***	-0.217**
Credit risk			
LOLTA	-0.008	0.011	0.104**
Control Variables			
RRR	-0.952***	-0.924***	-0.516**
IBR	0.037	0.034	0.012
M2GDP	0.020	0.019	0.009
Dummy Variables			
DARS	-0.481***	-0.482***	-0.349***
Constant	4.385***	4.407***	6.261***
Robustness tests			
F-statistic	28.732***	29.111***	18.555***
R2	0.639	0.642	0.744
JB-Test	3.265	3.205	3.633
Heteroscedasticity test	2.685***	2.681***	1.751*
VIF	2.771	2.793	3.906
Redundant fixed effects	-----	-----	3.987***
Hausman test	-----	22.76***	-----
Wooldridge serial corr.	0.380	0.399	1.252
No. observations	156	156	156

This table report the results of the twelfth model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (13) results

Dependent Variable (LQATA)	OLS	RE	FE
Internal Factors			
Profitability			
ROAE	0.021	0.006	0.009
Capital			
TCR	0.256***	0.274***	0.411***
Quality of Management			
CTIR	0.001	-0.001	-0.002
Bank Size			
MARS	0.125***	0.117***	-0.127*
Credit risk			
LOLTA	0.061	0.078**	0.111***
Control Variables			
RRR	-0.965***	-0.940***	-0.704***
IBR	0.001	-0.003	-0.038
M2GDP	0.019	0.019	0.012
Dummy Variables			
DARS	-0.486***	-0.488***	-0.345***
Constant	2.962***	3.028***	4.218***
Robustness tests			
F-statistic	28.761***	29.474***	20.145***
R2	0.639	0.645	0.759
JB-Test	2.612	2.871	2.746
Heteroscedasticity test	2.002**	2.094**	1.576
VIF	2.770	2.816	4.149
Redundant fixed effects	-----	-----	3.597***
Hausman test	-----	17.25**	-----
Wooldridge serial corr.	0.672	0.646	1.535
No. observations	156	156	156

This table report the results of the Thirteenth model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (14) results

Dependent Variable (LQATA)	OLS	RE	FE
Internal Factors			
Profitability			
ROAE	0.022	0.008	0.012
Capital			
TIER1	0.721***	0.775***	1.229***
Quality of Management			
CTIR	0.001	-0.001	-0.001
Bank Size			
MARS	0.125***	0.117***	-0.142*
Credit risk			
LOLTA	0.058	0.076**	0.110***
Control Variables			
RRR	-0.988***	-0.965***	-0.732***
IBR	-0.002	-0.006	-0.042
M2GDP	0.019*	0.019	0.013
Dummy Variables			
DARS	-0.492***	-0.494***	-0.346***
Constant	2.955***	3.019***	4.211***
Robustness tests			
F-statistic	28.818***	29.521***	20.703***
R2	0.639	0.645	0.764
JB-Test	2.476	2.687	2.905
Heteroscedasticity test	1.944	2.016**	1.449
VIF	2.770	2.816	4.237
Redundant fixed effects	-----	-----	3.801***
Hausman test	-----	17.66**	-----
Wooldridge serial corr.	0.664	0.643	1.710
No. observations	156	156	156

This table report the results of the fourteenth model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (15) results

Dependent Variable (LQATA)	OLS	RE	FE
Internal Factors			
Profitability			
ROAE	-0.032	-0.035	-0.049
Capital			
EQTA	-0.021***	-0.020***	-0.025***
Quality of Management			
CTIR	-0.002	-0.003	-0.007**
Bank Size			
MARS	0.092***	0.086***	-0.217**
Credit risk			
LOLTA	-0.008	0.012	0.054
Control Variables			
RRR	-0.952***	-0.924***	-0.542**
IBR	0.034	0.031	0.033
M2GDP	0.019	0.019	0.010
Dummy Variables			
DARS	-0.482***	-0.483***	-0.359***
Constant	4.474***	4.508***	6.505***
Robustness tests			
F-statistic	28.686***	29.067***	15.614***
R2	0.638	0.642	0.709
JB-Test	3.206	3.139	0.901
Heteroscedasticity test	2.654**	2.642**	1.799
VIF	2.762	2.793	3.436
Redundant fixed effects	-----	-----	2.737***
Hausman test	-----	22.74***	-----
Wooldridge serial corr.	0.388	0.407	0.925
No. observations	156	156	156

This table report the results of the fifteens model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (16) results

Dependent Variable (LQATA)	OLS	RE	FE
Internal Factors			
Profitability			
NIM	-0.063***	-0.088***	-0.169***
Capital			
TCR	0.257***	0.297***	0.406***
Quality of Management			
CTIR	0.001	-0.002	-0.005***
Bank Size			
MARS	0.136***	0.125***	-0.140**
Credit risk			
LOLTA	0.078**	0.103***	0.101***
Control Variables			
RRR	-0.894***	-0.815***	-0.460***
IBR	0.001	-0.007	-0.042
M2GDP	0.020*	0.019	0.009
Dummy Variables			
DARS	-0.473***	-0.462***	-0.296***
Constant	3.044***	3.063***	4.770***
Robustness tests			
F-statistic	30.658***	32.611***	30.119***
R2	0.653	0.667	0.825
JB-Test	3.139	3.024	2.962
Heteroscedasticity test	2.858***	2.839**	2.346*
VIF	2.881	3.003	5.714
Redundant fixed effects	-----	-----	5.479***
Hausman test	-----	65.65***	-----
Wooldridge serial corr.	0.240	0.162	0.067
No. observations	156	156	156

This table report the results of the sixteenth model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (17) results

Dependent Variable (LQATA)	OLS	RE	FE
Internal Factors			
Profitability			
NIM	-0.061***	-0.086***	-0.164***
Capital			
TIER1	0.696***	0.815***	1.176***
Quality of Management			
CTIR	0.001	-0.002	-0.004**
Bank Size			
MARS	0.134***	0.124***	-0.154**
Credit risk			
LOLTA	0.074**	0.099***	0.097***
Control Variables			
RRR	-0.923***	-0.845***	-0.486***
IBR	-0.002	-0.010	-0.044
M2GDP	0.021*	0.019*	0.010*
Dummy Variables			
DARS	-0.480***	-0.470***	-0.297***
Constant	3.083***	3.097***	4.793***
Robustness tests			
F-statistic	30.581***	32.549***	29.792***
R2	0.653	0.667	0.823
JB-Test	2.903	2.658	3.127
Heteroscedasticity test	2.797***	2.809**	2.200*
VIF	2.881	3.003	5.649
Redundant fixed effects	-----	-----	5.708***
Hausman test	-----	45.07***	-----
Wooldridge serial corr.	0.237	0.16	0.107
No. observations	156	156	156

This table report the results of the seventeenth model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.

Model (18) results

Dependent Variable (LQATA)	OLS	RE	FE
Internal Factors			
Profitability			
NIM	-0.057***	-0.065***	-0.161***
Capital			
EQTA	-0.017***	-0.016***	-0.008
Quality of Management			
CTIR	-0.002	-0.0023	-0.005**
Bank Size			
MARS	0.103***	0.097***	-0.231***
Credit risk			
LOLTA	0.011	0.032	0.095**
Control Variables			
RRR	-0.861***	-0.825***	-0.388***
IBR	0.025	0.021	-0.011
M2GDP	0.018	0.019	0.009
Dummy Variables			
DARS	-0.466***	-0.465***	-0.305***
Constant	4.324***	4.341***	6.534***
Robustness tests			
F-statistic	30.144***	30.682***	26.424***
R2	0.650	0.654	0.805
JB-Test	3.764	3.688	2.209
Heteroscedasticity test	3.630***	3.321**	2.118*
VIF	2.857	2.890	5.128
Redundant fixed effects	-----	-----	5.515***
Hausman test	-----	44.50***	-----
Wooldridge serial corr.	0.314	0.316	0.588
No. observations	156	156	156

This table report the results of the Eighteen model for capturing the causal relationship between liquidity risk and internal factors while controlling for regulatory and macroeconomic factors. The reported regression results are for the OLS, fixed and random effects. The sample contains data for the period 2004 to 2015 for 13 commercial banks. Standard errors in are clustered at the bank level. Hausman test results reveal that the fixed effect test is more suitable than the random effects model. * Statistically significant at 10%. ** Statistically significant at 5%. *** Statistically significant at 1%.